The Welding Engineer

AMERICA'S PIONEER TECHNICAL WELDING PUBLICATION

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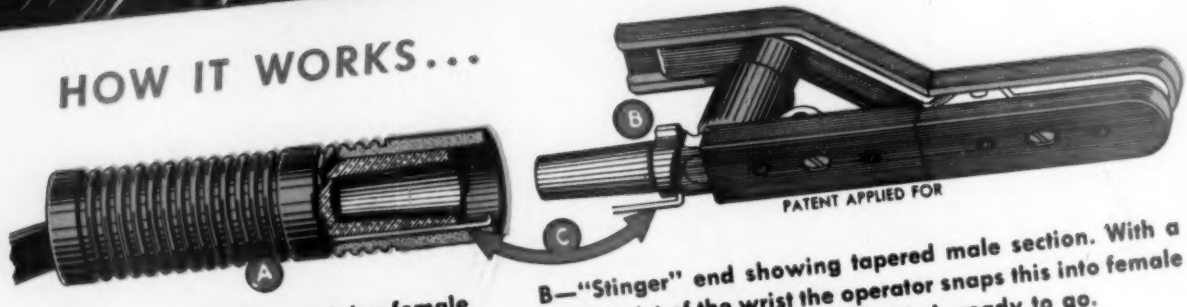

A—*Insulated* handle, containing female section of tapered cable connector which is soldered to cable lead.

B—"Stinger" end showing tapered male section. With a quick twist of the wrist the operator snaps this into female section in the handle (A)—and he's ready to go.

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The Welding Engineer

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What "Certified" Means to You

IN SMITHWAY WELDING ELECTRODES

☆ Every step in the manufacture of SMITHway Certified Welding Electrodes, from raw materials to concentricity and brushing, is subject to rigid shop and laboratory control, unparalleled in the electrode manufacturing business. Our reasons for going to this extra expense are twofold.

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SMITHway Welding Monitor: *cuts training time 33⅓%.* **SMITHway AC Welding Machine:** *more good welds per man-hour.*

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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

POSTWAR—WHAT?

What does the future hold for us after the fighting has been finished? Many have looked into the crystal ball, it would appear, and are divulging their revelations as postwar planning. Unfortunately, most of the thoughts so far expressed by the postwar planners have dealt with theories, conjectures and generalities, many of which start with a large "IF."

We all know that many things in the past would have been different if the right instead of the wrong move had been made. For this reason postwar plans cannot be based upon the premise of chance. We must *know* the move is right. Unless we are sure that it is, the move should not be made. This is the type of planning that will be needed—not the thoughts of dreamers but those of doers, producers.

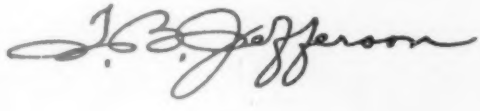
What are the postwar plans for the welding industry?

Consider the present first. Welding has advanced rapidly since the beginning of wartime activities. It is by welding, and only by welding, that we have been able to meet the demands placed upon the "Arsenal of Democracy" by a world at war. Because of these vast demands, welding has attained in two years a position in the industrial world which it might not have achieved until about five years from now had the normal trend of affairs been permitted to continue. Hence the all-important postwar problem of the welding industry is that of maintaining the heights thus reached.

During this period of wartime production, many fabricators have been introduced to welding—as a part of our postwar planning, we must see that they continue to use welding when they return to peacetime production. Though there is no logical reason why they should not, undoubtedly some of them will have to be convinced. In such instances, it will be up to the welding industry to show these fabricators how their jobs are to be done.

It will also be necessary to expand further the uses of welding. At present, this job is being done with the substantial aid of the Army and the Navy, but in a postwar era it will be solely the job of those in the Welding Industry.

Industry (the Welding Industry included) has shown a tremendous desire to win the war. This desire to win must be carried on with the same determination to win a renewed national prosperity in the postwar world. Let us convince the doubters that welding, one of the chief agents of Victory in war, can also help greatly to provide a free people with a better way of peacetime living.



This "BIG STICK Policy" ups production 140%

Teddy Roosevelt had a good idea in 1901 when he advised, "carry a big stick, and you'll go far."

Yes, by today's arc welding standards that "Big Stick Policy" is still good.

Right! USE THE BIGGEST POSSIBLE STICK OF ELECTRODE, AND YOU'LL GO FAR.

Look what they're doing in this shop. By boosting electrode size, output of tank track sections was increased like this:

Size "Fleetweld" Electrode	Parts Welded Per Hr.
1/8"	10
5/32"	17
3/16"	24

Swell! 3/16" electrode may not be a giant but it got "big stick" results here . . . an output increase of 140%. Some shops are boosting electrode size up to 3/8". It all depends on the nature of your work. You can get "big stick" advice from Lincoln.

THE LINCOLN ELECTRIC COMPANY
Cleveland, Ohio

Fig. 1—These streamlined airplane fuel tanks are made of auto body steel, 0.024 in. thick. Though weighing 1,000 lb apiece when full, two such tanks will retard the speed of a Lockheed Lightning by only 4% at the most.

Tear Drops for Tojo!

Spot and seam welding make possible the production of streamlined releasable gasoline tanks, two of which will double a plane's normal flying range. A finished tank now leaves the Lockheed plant every 4½ minutes.

AT ONE of the branch plants of the Lockheed Aircraft Corp., near Los Angeles, "tear drops" for Tojo, Hitler and Mussolini are being plucked off a conveyor line, packed into crates and rushed off to the fighting fronts at a rate of one every 4½ minutes. These tear drops, each 10 ft long and 27 in. in diam at the widest point, are pictured in Fig. 1. They are the streamlined, laminar flow drop tanks which enable Lockheed Lightning P-38's, Vega Ventura bombers and other American aircraft to carry the aerial war right into Axis backyards.

Will Double Flying Range

Each tank weighs 90 lb when empty, and 1,000 lb when filled with 165 gal of gasoline. Two such tanks will approximately double the normal range of a Lockheed Lightning. Yet the aerodynamics problems have been so skillfully overcome that the two tanks, when full, will reduce the speed of this fast airplane only 4% at top speed. The tanks are carried one under each inner wing section, as shown in Fig. 2. They are fastened to regular bomb shackles, and may be dropped by the pilot whenever necessary.

In production 90 days after the order was placed by the United States Army Air Forces (though at that time there was not a tank even on the Lockheed drafting boards), the remarkable output of this continuously moving conveyor line was made possible through the use of some of the most ingenious spot, roll and seam welding equipment yet devised.

Fig. 2—The two tanks are carried one under each inner wing section as shown here. They are fastened to regular bomb shackles and may be dropped at the will of the pilot. Each tank contains 165 gal of gasoline.

Fig. 3—Two half shells ready for mating. The shells are formed in a hydraulic press outside the Lockheed plant. All the work of assembly, including welding, is performed on a conveyor.

The Army made an urgent request for a tank that would: (1) cost less, (2) use no critical material and (3) be adaptable to a much higher rate of production. At the time, an aluminum tank was being manufactured for Lockheed by a nearby subcontractor; the first 2,000 of these had cost the Government $678 apiece. Lockheed was given three months to go into production on a new-type tank that would meet the three requirements stated above. Despite the fact that at that time no such tank had ever been designed, the product was produced on schedule to help carry the war to the enemy's home grounds.

Use Auto Body Stock

Hall L. Hibbard, vice-president and chief engineer of Lockheed, assigned Chief Production Engineer Harold Harrison to the job of designing the new product. The result—after one tank in quarter sections had been tried and rejected and after hours of wind tunnel and static vibration tests—is a tank made of auto body stock (SAE 1010 steel, 0.024 in. thick) which sells for less than $100. It is built in two half shells, as shown in Fig. 3, and is undoubtedly the most streamlined storage tank ever made.

The manufacturing engineering department was assigned the problem of devising a conveyor system that would turn out 130 tanks a day. A manufacturing engineering group under L. H. Ferrish came up with a system that now more than doubles that figure. This system has set an eight-hour shift record of 130 tanks—one every 3.7 minutes.

The present high production rate is made possible largely through the use of some very clever spot, roll and seam welding equipment that was conceived by Harry Chiles of the plant engineering department and designed in collaboration with the plant engineering equipment design group. Two of these special welders are believed to be the first of their types constructed in this country: one a portable seam welder, Fig. 7, and the other a roll-spot welding fixture, Fig. 5. The functions of both of these machines will be discussed later.

Two Conveyor Lines

An investigation of Lockheed's available floor space, power and equipment showed that Plant 4 offered the best possibilities for this project. After much discussion and reworking of plans, a satisfactory layout was developed and built around a plan for using two continuous conveyors. These permit the assembly and processing operations to be performed while the tank is being moved. Much of the equipment set up on this line was secured from peacetime use, the conveyor lines themselves being purchased from the Studebaker Co. with a proviso that Studebaker was to have the option of repurchase at the end of the war.

The first or assembly conveyor is an overhead conveyor from which 36 cradles are suspended, each cradle holding one tank. The cradles are spaced 18 in. apart, and the complete assembly conveyor is 475 ft long. The welding and assembly equipment are located at various stations along the conveyor line in the sequence in which the operations are performed. Before mating, left and right hand shells alternate on the assembly conveyor.

The tank leaves the first conveyor line to enter a slushing table, where the inside is completely coated with a special zinc chromate primer as protection against corrosion. It is then placed on the second conveyor, the processing and shipping conveyor, which carries the tank through various processing stations and finally to a platform beside the freight cars where it is crated for shipping.

Under the present production schedule, the conveyors move at a rate of 43 in. a minute. The average output for all three shifts is a tank every 4½ minutes.

All of the parts for these tanks are fabricated by subcontractors, delivered to Lockheed Plant 4 and there assembled by scores of men and women working in three shifts. The half shells are formed in a hydraulic press, this work being done outside.

Seam Welding Filler Well

The first operation in the Lockheed plant is the torch welding of the sump plug flange to the left hand skin or shell. The filler well adapter assembly is next seam welded to the left hand

Fig. 4—One of the early operations is the seam welding of the filler well adapter assembly to the tank skin. This weld must be made on a double contoured surface. There are two welding wheels in the machine, and the circuit is closed by a circular copper alloy bar, which may be seen just below the skin.

Fig. 5—Four of the seven bulkheads within the tank are to be welded by the semiautomatic seam welding machine shown below. When the hinged cover is let down and the power applied, roller spot welds will be made along the arcs of the bulkheads. The entire "stitching" operation requires but one minute of actual welding time.

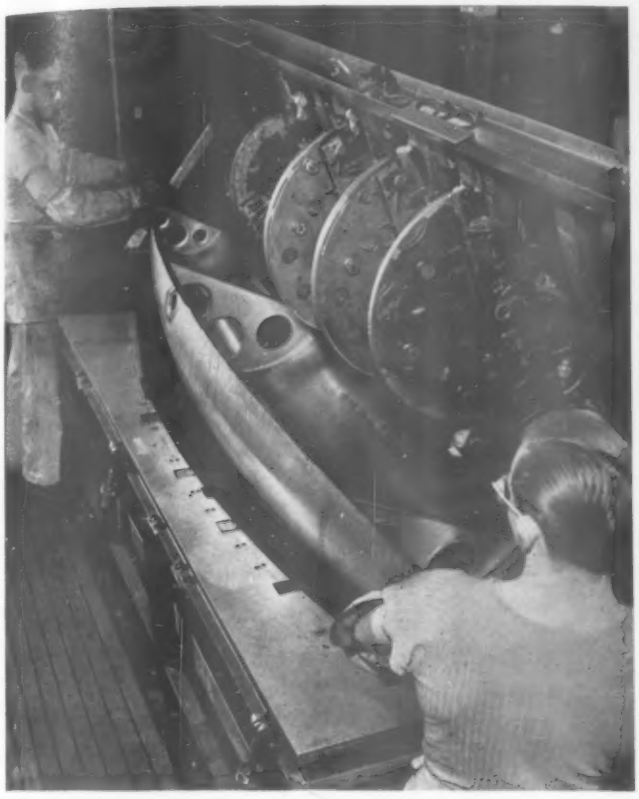


Fig. 6—An overhead monorail allows this operator to follow the moving conveyor with his portable welding gun. He is welding a "keelson angle" to the skin and bulkheads, this being a structure which functions like the keel of a boat in distributing the load over the whole tank. Other welding gun operators spot weld other small parts while the half shell of the tank moves along the conveyor line at 43 in. per minute.

skin, Fig. 4, in a special series welder designed by Lockheed. This machine is similar to conventional series seam welders, such as those used in welding discs to shells, but it is somewhat unusual since the weld is made on a double contoured surface having a rise of ¾ in. in 90 deg of rotation.

The shaft housings, welding shafts and welding wheels of this seam welding machine are connected to each other and bolted to a casting which rotates on a hollow, vertical-mounted shaft. The inside diameter of this shaft is large enough to admit the water-cooled welding cables which connect the two sides of the transformer secondary to the cast copper shaft housing. The circular copper alloy short circuiting bar has its upper face contoured to fit the inside of the tank, and is mounted horizontally below the two welding wheels.

When the two wheels contact the tank skin and the filler well adapter assembly, the welding circuit is closed by the circular short circuiting bar. Since the welding current flows through the sheets at two points, two welds are made simultaneously, and the 360 deg of welding is completed in approximately 185 deg actual rotation of the upper heads.

The next operation is the welding of bulkheads to both the left and right hand skins, seven to each shell. This is done by two special, Lockheed-designed semiautomatic seam welding machines, Fig. 5, which are set for spot welding operation. The first machine welds three bulkheads in place, the second the remaining four. The two machines were designed, constructed and installed in ten weeks.

When placed in the machine, the half shell is supported at the bulkhead stations by copper alloy electrode bars. These were machined to fit exactly the outside contour of the pressed steel tank section. An equal number of electrode wheel units rotate about the longitudinal axis of the tank and are fastened to the hinged cover of the fixture that holds the tank sections. Each of these units consists of a welding wheel and shaft, shaft housing, guide casting, an air cylinder 3 in. diam by ¾ in. stroke, a $\frac{1}{12}$ hp driving motor, reducing gear box and the necessary gear train to drive the welding wheel shaft. The sequence panel and welding transformer are outside the fabricating jig proper.

The roller spot welds are controlled by a non-synchronous pulsation-weld timer panel with an electronic contactor. The timers were slightly modified by Lockheed to secure the desired sequence of operation. In the two center bulkheads the welds are spaced ½ in. and in the bulkheads ¾ in. apart, center to center. Welding time is one minute in each machine. Another minute is devoted to loading and unloading.

Traveling Gun Welders

The half shells are now placed on the moving conveyor, each in its own cradle, while flanged gussets and other parts for holding the tank to the airplane are located and spot welded to the stressed bulkheads. These operations are performed by a series of gun welders, Fig. 6, which are mounted on monorails so that each operator is able to follow the tank along the floor until his particular welding job has been completed.

A portable seam welder, Fig. 7, is next used for welding the two halves of the pan to the halves of the tank. Designed and constructed by Lockheed, this welder is supported from a pneumatic counter balancer of 175 lb capacity. The welding is done while the half tank is on the moving conveyor. The linear travel of the seam welding wheels is approximately the same as that of the conveyor—43 in. per minute—but the wheels were

Fig. 7—This portable seam welder is one of the innovations designed by Lockheed and is used for seam welding the two halves of the pan to the halves of the tank. The seam welding wheels rotate in the opposite direction to the conveyor travel.

Fig. 8—Seam welding the two halves together. The excess metal will be trimmed off with an electric shear. Four minutes per tank is the time required for this final seam welding operation.

designed to rotate in the opposite direction from that of the conveyor. The result is that the welder itself actually moves less than 18 in. during the entire welding operation.

Lack of space prevents discussion of the other welding stations at which various other small parts are put in place. In all, the tank passes through nine separate welding stations, three of which are seam or roll-spot welders. Meanwhile, fuel lines and vents are gas and tack welded in place, and power driven socket wrenches are employed to bolt on the attachment hooks.

Mating the Shells

After a final clean up to make certain that there are no loose parts, the right and left half shells are mated and clamped together. Prepunched holes in the standing seams are used for aligning the two halves. The parts are tack welded together by a gun welder, and the tank is taken off the line and placed in a special cradle for the seam welding that completes the mating.

This seam welding, Fig. 8, is done at the rate of 60 in. a minute—a total of 4 minutes per tank. Excess material on the standing seam is then trimmed off with an electric shear.

The tail plug flange is torch welded into place, this operation being performed by a woman weldor, as shown in Fig. 9. The tank is then placed back onto the conveyor for leakage testing by means of compressed air (pumped inside) and an application of soapy water.

The tank is now ready for the slushing table. This "table" is a revolving cradle holding two tanks, one on each side. In each tank are poured 30 gal of non-inflammable zinc chromate primer. The slushing table is so rotated that the fluid flows over every portion of the inside of the tank, covering the entire inner skin and bulkheads with a corrosion-preventive coating. After "slushing," the tank is loaded onto a drying dolly and dried with hot air. It is then given a final pressure test.

The Processing Conveyor

The permanent tail plug is now screwed into place, and the tank placed onto the second or process conveyor. This takes it in turn through a hot bath cleaning solution, a cold water rinse, a drying oven and a paint booth. After two primer coats and the final camouflage paint have been applied at the paint booth, the same conveyor carries the tank up through a window into the shipping building (where it goes high over the railroad tracks) and onto a platform where a girl installs decals showing the manufacturer's nameplate, tank capacity, etc., and affixes anti-sabotage seals over all openings. The line moves outdoors; a protective coating to prevent salt water corrosion is applied by a spray gun, and the tank is returned to the shipping building for crating. The crated tank is placed aboard a freight car and shipped to one or another of our many fighting fronts.

Fastened in place beneath the wing of a P-38, a Vega Ventura, a Vega PV-1 or other American planes, these tanks allow our fast, hard-hitting aircraft to reach ever more distant destinations.

Tear drops for Tojo!

Fig. 9—Torch welding the tail plug flange, one of the last operations to be performed on the assembly conveyor line. The weldor—a certified weldor on the swing shift—is Marjorie Coon, whose husband is in the Air Corps.

Why I Am a Weldor

A lady weldor "true confesses" her opinion of the job. Her company's feminine weldors selected Miss Eads to express the sentiments of them all.

By **IRENE EADS**
Link-Belt Ordnance Co.

WHEN I decided to go into war work, I wanted to do the type of work in which I could feel that I was accomplishing something worth-while. I believe it is most important to be deeply interested in any job in order to achieve the best results, and after months at an occupation which has proved a rigid test I am more convinced than ever that welding is just that type of engrossing job.

During my six weeks in welding school, there were many times when I doubted my eventual ability to pass the Government test. Nevertheless, my desire to train myself to become efficient at a new and challenging job impelled me to continue. During the first few weeks, scarcely any member of our class realized the importance of our training. Entering a field so completely foreign in every respect as compared to our previous occupations, we were slow to realize how essential would be our place in industry.

Before we were enrolled as weldors, I suppose most of us thought we would become defense glamour girls in snappy uniforms and colorful play shoes. However, after our first glimpse of ourselves in men's roomy overalls and other regulation safety apparel, these ideas were promptly discarded, for somehow our feminine appearance began to diminish as the real worth of the job began to unfold.

Speaking of protective clothing devices, I shall never forget my first attempt to buy safety shoes. Another somewhat bewildered student weldor and I went to a Chicago Loop store and with some uncertainty told the sales girl what we wanted. When we mentioned the approximate weight of steel the shoes would have to bear, she audibly gasped and in all sincerity exclaimed, "For goodness' sakes! If I were you I'd stay away—*far* away from steel!"

After these confusing six weeks in a new world, we took the Government welding test and quite suddenly found ourselves Weldors . . . at least *we* thought we were. However, the more experienced people in the shop twinkled with skepticism, for we were the "guinea pigs" of this experiment. As a matter of fact, we didn't have the slightest idea where to start on a job until somebody showed us the exact spot on which to strike the arc.

Welding is not an easy job. It is dirty, hot and tiresome, and requires intense concentration and endless patience. Nevertheless, in spite of all the discomforts and very real physical effort, it still remains so fascinating and so very absorbing I am sure I wouldn't give it up for any other work, especially during this crisis, when we can truly feel confident that we are doing a "man's job." Despite our real fatigue and petty surface grumbling, I think all the girls feel as I do. I have heard them say many things about welding, but never once have they intimated that they didn't like it. I feel I have really accomplished something when I see the completed gun and know that my welding number is stamped on some vital part.

I think that all the women weldors at Link-Belt Ordnance have come to understand how much their combined strength and ability will mean to the nation in winning this war. Speaking for myself, I can honestly say that the past five months I have spent in the steel shop have been well worth every aching muscle, every drop of sweat (and I've shed many a drop) and every callous on my hands it has cost me to remain there. I have no desire to spend the rest of my life keeping my eyes focused on an arc light, but, knowing I will be doing just that for sometime to come, I am content in the knowledge that my own hands are in some small way helping the cause for which all of us are fighting.

Women soldiers of the production front are these girl weldors of the Link-Belt Ordnance Co. Women now comprise one-sixth of the plant's entire personnel.

Weldors' Eyes—

Eyes are man's most valuable asset.

Let's Protect Them

His eyes are man's greatest asset; there is no substitute for the ability to see. Though all of us realize the value of these two organs of sight, too many eyes are now being subjected to severe punishment. Weldors' eyes should always be shielded from harmful radiation.

By **T. B. JEFFERSON**

THE REWARDS of a life of welding have been pictured to newcomers as tuberculosis, sterility and blindness. These "scarey" remarks, fortunately, come only from those entirely ignorant of the true facts. Welding fumes, state these calamity howlers, will result in weakened lungs, yet medical authorities have proved the contrary through years of observation. Naturally, there are some dangerous fumes, but these atmospheric hazards can be readily removed by adequate ventilation and proper protective measures.*

The sterility bugaboo has long been a standing joke among weldors. It has absolutely no foundation in fact. As one physician said, "Sterility can be caused only by tissue-killing rays such as X-rays, but welding machines do not produce X-rays; they produce ultra-violet and infra-red rays."

Dangerous as the Sun

Ultra-violet and infra-red rays, however, can produce ill effects (like certain welding fumes) unless the eyes and skin are adequately protected from them. Long ago, man learned that the sun's rays are harmful to his eyes, so he never looks directly at the unclouded sun. The radiation from welding heat sources is injurious to the eyes for exactly the same reason. Bearing in mind the irritating effect on the eyes produced by bright sunlight, it is easy to understand how the brilliant gas flame or superbrilliant welding arc may harm the unprotected eye.

In welding and cutting operations, the radiation from intensely heated solids or gases may be in one of three classifications: (1) invisible ultra-violet rays, (2) visible light rays, (3) invisible infra-red rays. There is no clear line of demarcation between these divisions, which melt into one another like the colors of the visible spectrum.

Strong ultra-violet rays are capable of causing severe inflammation similar to sunburn on both the eyes and surrounding membranes. Extremely intense visible light rays may cause eye strain and possibly temporary blindness. Infra-red rays, as will be shown later, are not absorbed but penetrate the eye. They are thought to be capable of causing cumulative effects which might lead to cataracts, retina injuries, as well as to opacity of the cornea and the aqueous chamber. The intensity of the ultra-violet and the infra-red radiation is determined by the temperature of the welding source. Consequently, it is greater for the arc than for the gas flame. The surroundings also effect the intensity, depending upon whether the radiation is absorbed or reflected.

The Eye and Its Structure

To obtain a better understanding of the problems of eye protection, it may be well to discuss briefly the structure of the eye (Fig. 1) and its mechanisms of potential danger.

An eye, for all practical purposes, may be said to consist of a sphere or ball. This sphere or, as it is more aptly termed, eyeball is divided into two chambers: the anterior and posterior chambers. The anterior chamber includes the conjunctiva, cornea, iris and lens.

The conjunctiva is the outermost portion of the eyeball structure. Lining the inner surface of the eyelid, it is a thin, almost transparent, mucous membrane which comes forward as a cover of the side of the eye until it reaches the area around the cornea. When the conjunctiva becomes inflamed, the eyeball becomes bloodshot, and the sensation of having sand in the eye is experienced. This complaint is not an uncommon experience among arc weldors.

That glistening transparent eye coat within the center of the eye is the cornea. The cornea contains near the surface numerous nerve ends which are capable of registering pain. It is by this provision that nature has made an attempt to protect the eye from injury by foreign pieces and it it here that the eye makes its first important effort to protect itself against injurious radiation.

Directly behind the cornea is an area known as the aqueous or aqueous humor of the eye. The aqueous humor is of much the same composition and appearance as tears, and rapidly reforms if lost by accident or injury. Suspended in the aqueous humor is a muscular diaphragm, the iris. The term pupil is commonly applied to the area inside the aperture of the iris diaphragm.

Lens and Retina

The crystalline lens of the eye is set immediately behind the pupil and

*For complete discussion of welding fume hazards see "Fumes from Arc Welding," pages 27-31, THE WELDING ENGINEER, December, 1942.

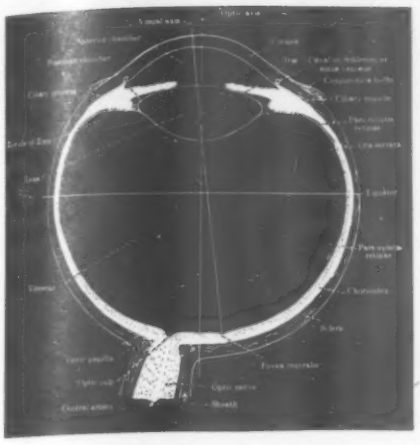


Fig. 1—Schematic section in a horizontal meridian of the right eyeball. Modified from Toldt's Atlas.

it is the forepart of the posterior chamber. It is this lens which focuses rays of light to point on the retina, where the focal images are picked up and carried by the nerve fibers to the brain.

The vitreous humor which fills the posterior chamber does not possess the power of rapid regeneration like the aqueous humor. If much of it is lost by accident, the eye is proportionally and permanently damaged.

The retina on which the lens focuses its light rays embodies rods and cones. The rods enable us to see in darkness and to discern movement, while the cones function in the seeing of detail and the discerning of color. Finally, surrounding the entire eyeball with the exception of the cornea, there is a rather tough fibrous coat known as the sclera. The sclera, commonly known as the "white" of the eye, functions as a protective membrane and for maintaining the shape of the eyeball. The chorioid between the sclera and the retina contains the arteries and veins which furnish the nourishment and maintain the warmth of the delicate eye nerve fibers.

As previously mentioned, eye injuries from welding operations result from brilliance of radiation from three sources: (1) invisible ultra-violet radiation at one end of the spectrum, (2) visible light rays in the middle of the spectrum and (3) invisible infra-red radiation from the other end of the spectrum. These three sources in general include the three principle divisions of the spectrum (see Fig. 2).

Ultra-Violet Rays

Ultra-violet radiation is invisible and has a wave length ranging from 400 millimicrons (a millimicron is one millionth part of 1 mm) down to 90 millimicrons at the X-radiation end of the spectrum. These rays are principally to be feared not only because they are invisible but because we have no organ or sense for detecting them, and their existence can only be traced by its effects.

All of the ultra-violet radiation of a wave length shorter than 290 millimicrons is absorbed in the atmosphere. Hence the weldor is concerned only with radiation above 290 millimicrons. The cornea will absorb all rays up to those having a wave length of 295. Ultra-violet radiation having wave length between 300 and 380 (in some cases up to 400 millimicrons in older persons) is absorbed by the crystalline lens. The absorption of these short wave length rays has a tendency to cause the crystalline lens to fluoresce (shine in the dark as do the eyes of a cat), which may disturb vision. Other than this difficulty, the ultra-violet rays may affect the eye in a manner quite similar to sunburn. Either of these conditions is sufficiently serious to warrant the wearing of ultra-violet absorption lenses.

When the presence of ultra-violet rays is known, it is very easy to guard against them. There are very few materials that are transparent to both ultra-violet and common light, and all are crystalline materials not in common use. Moderately thick ordinary clear glass, sheets of clear or amber mica, or of clear or colored celluloid or gelatin are opaque to ultra-violet rays.

When operating in a source of light that is known to be rich in ultra-violet, such as the iron arc in welding operations, it is not sufficient to guard the eyes with ordinary spectacles. These invisible rays are capable of reflection just the same as visible light, and the slanting reflections may easily reach behind the spectacle lens and injure the eye. Goggles that fit around the eyes are the only sure protection. For the same reason, a hand shield should be held close against the face and not several inches away.

Infra-Red Rays

The problem, however, is greater than that of merely shutting out ultra-violet rays. Provision must also be made to protect the eyes of the weldor from infra-red radiation. These rays have a wave length ranging from 750 to 2,000 millimicrons. Infra-red rays are frequently termed heat rays because they are absorbed and changed into heat when they encounter any material which they cannot penetrate (which is opaque to them). These rays are the ones which produce the sensation of heat when they fall upon the skin, and prolonged exposure to infra-red radiation will result in a sunburned condition.

Medical authorities are of the opinion that the absorption of the eye for infra-red radiation is only 6% to 9% at the dividing line between visible red and infra-red. Thus 91% to 94% of all radiation carried by wave lengths of 760 millimicrons reaches the retina. The iris, because of its opacity, absorbs the greater part of all these radiations. The absorption of the iris for infra-red is approximately 75% to 80% of all wave lengths between 750 and 1,300 millimicrons.

The amount of radiation that is incident upon the iris is the same as that incident upon the pupil through the lens. The lens, however, absorbs only approximately 12% of radiation from a wave length between 750 and 1,300 millimicrons. Consequently, the effects of these rays upon the unprotected eye may be serious—much like a sunburn within the eye. It is, therefore, very necessary to guard the eye against infra-red radiation.

Although these rays are absorbed to a certain extent by ordinary colored lenses, this is not sufficient pro-

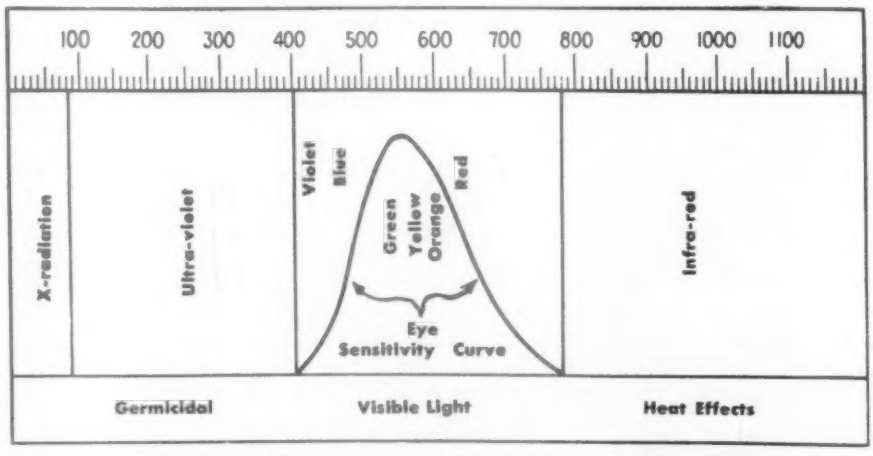
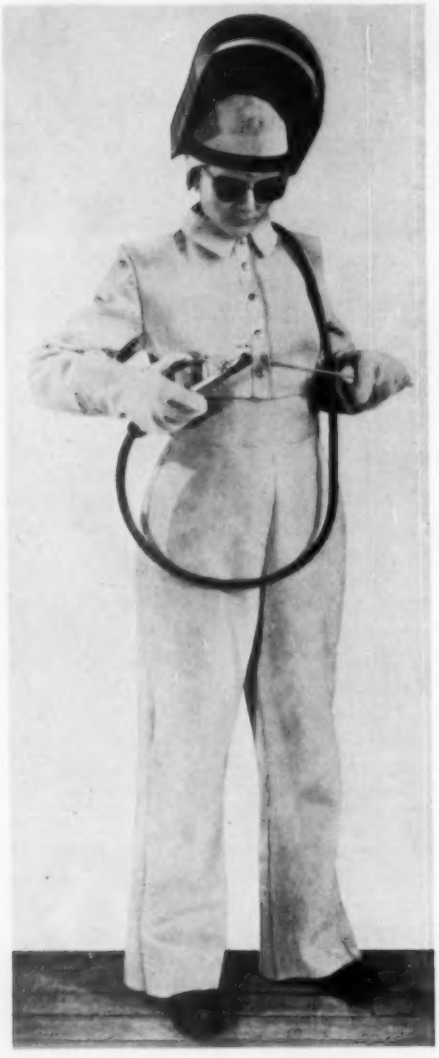


Fig. 2—Wave lengths of various radiations of the spectrum in micromillimeters.



Courtesy, American Optical Co.

Fig. 3—What a well dressed woman welder will wear. Note the protective goggles which are worn under the helmet, protecting the eyes from flash as well as "popping" scale at all times.

tection against any intense source. Fortunately, there are several kinds of glass which, although fairly transparent to visible light, have a wonderful power of absorbing heat rays.

Visible Radiation

There is more to protective lenses, however, than protection against invisible ultra-violet and infra-red radiation. We must also consider the effects of visible radiation.

It is a well known fact that the normal eye shows considerable chromatic aberration towards the red and violet ends of the spectrum. This difficulty is completely corrected within the range of middle colors. It naturally follows, therefore, that a much clearer definition of an object will be obtained by a combination of yellow and green light than by red light alone or especially by blue or violet light alone. The eye is also more sensitive to yellow and green rays than it is to red and blue rays. For this reason, yellow-green light has the highest luminous efficiency. This may be easily verified by looking at a sunlit landscape or fleecy clouds in a blue sky through plates of different colored glass. A glass of a light amber color or amber slightly colored with green will bring out details which are scarcely observable without the glass and are obscured completely by blue or violet glass.

Obviously, the selection of a color hue for a welding lens should be properly decided by an expert in order to obtain the clearest definition of vision with the least amount of glare, but the depth of tint may be best determined by the operator himself, owing to individual differences in visual acuity which will permit one man to see clearly through a glass which is too dark for another man.

Absorption lenses which cut out a good deal of ultra-violet and infra-red radiation thus remove a good proportion of what might be termed dead load. While they may cut down the useful illumination to 60% of the former amount, the ratio of useful load to dead load is changed in such a favorable proportion as to make for better visual acuity. The reason for this is because the pupil of the eye will be dilated at the lower illumination and thus admit more light. The increase in the pupil diameter decreases the diffraction and therefore increases resolution or the ability to distinguish objects.

From the above observations, we find that in welding operations the eye should be adequately protected from invisible ultra-red and ultra-violet radiation. For eye comfort, the eye should also be protected against visible radiation at the extreme ends of the visible light spectrum. All of these protective measures can be given by an adequate colored lens. Not just any lens will do, however; it must meet definite specified standards.

Standard Specifications

The National Bureau of Standards has developed such specifications, which require that the density of the lens be designated by shade numbers. The transmission value of radiant energy — infra-red, ultra-violet and visible light—is required to conform to specific limitations given in Table I. The lens must be uniform over its entire surface to within 10% of the most dense part (density is measured by the transmission of incident light). These lenses must also possess maximum transparency between 525 and 600 millimicrons with gradual increasing absorption at either side, the dominant hue being yellowish green.

Lenses are sometimes defective and should be carefully examined for defects which might cause discomfort. They should be examined especially for pinholes or bubbles which might permit the passage of high intensity light since such defects will cause the wearer's eye to stray unintentionally toward the light source and thus result in eventual discomfort. Some lenses, especially imported ones, are found to have absorption of different bands in the orange-yellow portion of the spectrum. Inexpensive or imported lenses are again found to have another common fault, that of transmission of ultra-violet or infra-red radiation. Care should also be taken to see that both lenses of goggles are of the same shade. These various lens defects may cause operator eyestrain or prevent adequate protection.

Table I. Transmission for Eye Protective Lenses

Shade No.	Permissible Variation, Per Cent			Total Infra-Red, Per Cent	Total Ultra-Violet, Per Cent
	Maximum	Standard	Minimum		
3	22.9	13.9	8.7	9.0	0.2
4	8.51	5.18	3.24	5.0	0.2
5	3.16	1.93	1.20	2.5	0.2
6	1.18	0.72	0.45	1.5	0.2
7	0.44	0.27	0.17	1.3	0.1
8	0.162	0.10	0.062	1.0	0.1
9	0.060	0.037	0.0230	0.8	0.1
10	0.0229	0.0139	0.0087	0.6	0.1
11	0.0085	0.0052	0.0033	0.5	0.05
12	0.0032	0.0019	0.0012	0.5	0.05
13	0.00118	0.00072	0.00045	0.4	0.05
14	0.00044	0.00027	0.00017	0.3	0.05
Clear Lens	——	92.0	89.0	—	—
Cover Glass	——	92.0	89.0	—	—

NOTE: Visible transmission is based on the percentage of the visible radiations of a gas-filled, tungsten-filament 200-w, 115-v lamp determined photometrically.

Table II. Welding Lens Shade Recommendations

Welding Application	Lens Shade No.
Light welding or lead welding	4
Spot welding min	5
Flame-cutting min	5
Gas welding	5
Gas welding	6
Gas cutting	6
Arc welding to 30 amp	6
Heavy gas welding	8
Arc welding and cutting to 75 amp	8
Arc welding and cutting 75 to 200 amp	10
Arc welding and cutting 200 to 400 amp	12
Arc welding and cutting over 400 amp	14

Fig. 4—The protective lens of the welding helmet should be protected from weld spatter by a cover glass. This is especially essential when doing overhead welding.

Courtesy, American Optical Co.

They must be avoided for maximum efficiency.

Metallic Coated Lenses

In one instance, a manufacturer of welding lenses has supplemented the yellowish-green hue of the lens with a thin metallic coating. Scientific investigators have determined that metallic films less than one wave length in thickness, although having a declining value for ultra-violet rays, reflect high percentages of infra-red radiation while allowing visible light to pass through. Such a phenomenon makes the metallic film ideally adapted to fulfill the requirements of an arc welding protective lens.

A lens of this type may be produced by carefully depositing a thin film of silver (silver has the highest infrared reflective values of any metal, ranging from 95% at 700 millimicrons to 99% at 4,000 millimicrons) on a glass of suitable characteristics with respect to ultra-violet and visible light radiation. When the film is combined with proper variations in the color of the glass, the entire range of standard shades of the National Bureau of Standards (Table 1) may be produced.

Regardless of the shade of lens used for arc welding, it should be protected by a cover glass. This may be a thin clear glass plate or a clear sheet of celluloid. It is placed on that side of the protective lens exposed to the arc so that the globules of molten metal, molten slag or other molten particles of weld spatter (which might otherwise come in contact with the protective lens) will adhere to the cover glass rather than to the expensive lens plates. For longer life, cover glasses are sometimes coated with a chemical solution which makes spatter adherence difficult.

After a satisfactory lens has been adopted, the welding operator should be permitted to select the shade or density of color that is best suited to him for his particular work. The sharpness of vision of different individuals differs considerably so that a man with very good eyesight may get a clear definition of his work from a lens that would be too dark for another man. The desired lens is the one of the darkest shade which will show a clear definition of the work without eyestrain.

Recommendations have been established as to the shades of lens that should be used in various welding operations. These shades vary from No. 5 for light gas welding operations to No. 14 for arc welding or cutting with 400 amp or more. These recommendations are given in Table II.

Only goggles need be worn for the lighter operations; *i.e.*, light welding or cutting applications with either the arc or gas. For heavy gas welding operations requiring a No. 8 shade lens, arc welding requiring 75 amp or more and cutting applications, it is recommended that the weldor wear either a helmet or shield so as to protect his face and neck from radiation.

Goggle Cleaning Stations

The lenses of welding goggles and helmets, like the corrective lenses of glasses, should be kept clean. In Fig. 5 is shown the manner in which a large industrial firm is aiding its workers to keep their lenses clean. About the plant there are conveniently located soap-and-paper dispensers at which a worker may readily clean his goggles or the welding lenses in his helmet. A drop or two of the cleaning solution and a piece of paper quickly do the job. Without such facilities, workers are apt to wear goggles longer between cleaning than they should, with a pronounced drop in visual efficiency. Such cleaning stations, which merely consist of a standard type dispenser for the solution and papers mounted on a board, should be readily located by identifying signs.

Besides lenses, the other parts of goggles and helmets should be occasionally cleaned. Such cleaning is necessary to remove grease and dirt and other materials which might be harmful from the contact surfaces of the equipment. Materials of rubber, rubber composition, metal, plastic, leather or fiber should be thoroughly scrubbed with a stiff brush with a warm soap and water solution until the grime is removed, then rinsed in cold water. Solvents such as carbon tetrachloride, gasoline or naphtha are not recommended for these cleaning operations because they may induce skin rash unless thoroughly removed from the surfaces which come in contact with the face or head. These solvents also manifest a tendency to injure rubber parts.

Sterilizing Equipment

Like respirators, goggles and helmets should be occasionally sterilized. Manufacturers' recommended sterilizing agents should be used since, in every instance, the manufacturer has selected a particular agent that will not harm the product. Usually, however, there are many other ways in which the equipment may be sterilized: for example, exposure to live steam for 5 minutes, immersing in boiling water for a period of not less than 5 minutes, immersion for 10 minutes in a formalin solution made by taking 1 part of 40% formaldehyde solution and 9 parts water. When using the formalin solution for sterilizing, the part should be washed in a warm soap and water solution, dipped in boiling water and air dried.

Screens and Booths

In addition to weldor protection, it should be remembered that there are other workers about the plant who are indirectly or temporarily exposed to harmful radiant energy. These must also be protected by surrounding the welding operation with screens or booths. A booth, naturally, is the best means of shutting off the arc rays from the unprotected men working nearby. Frequently, however,

the work is of such character that only a screen can be used.

When building a booth for arc welding operations, care must be taken not to paint the interior with a paint that reflects the arc rays and so subjects the operator to reflected radiation from the side or back of his helmet. Only paint which will absorb the dangerous rays should be used on the interior of the booth and on all machinery located within it. Such a paint may be obtained by mixing zinc oxide, oil and turpentine and adding lamp black to secure the desired dark tint.

In automatic arc welding operations, it is frequently found desirable to enclose the arc in a cabinet and provide a colored glass protective window through which the operator may watch the progress of the welding. The enclosed cabinet renders it unnecessary for the weldor to wear a helmet and adequately protects all workers in the vicinity from the rays of the arc.

Flashed Eyes

Despite all precautions, flashed eyes are sometimes experienced—more often among persons working nearby than those engaged in the actual welding. The hazard of this affliction, it should be noted, is not confined wholly to welding or cutting operations but is prevalent in electrical repair work, motion picture studio work, motion picture machine operation and studio photography.

The symptoms of flashed eyes are a pronounced irritation under the eyelids, a feeling as if there were "sand in the eye." These symptoms usually develop several hours after exposure, which means that they frequently develop after the worker has left the plant—sometimes late at night in places where no doctor is readily available. To guard against this malady, care should be taken to see that those working near the weldor—and all visitors—are either completely screened from the welding operations or else provided with suitable goggles.

The injurious effects of ultra-violet and infra-red radiation upon the eyes of the individuals working adjacent to the weldor are naturally the same as upon the eyes of the weldor, though minimized in severity in accordance with the square of the distance. The injurious light rays follow the same reversed square law which governs the intensity of visible radiation at a given distance from its source. Thus the intensity of radiation at a distance of 10 feet from a weldor is approximately 1/100th of the radiation to which the weldor is exposed at the weld.

Immunity Distances

Opinions differ as to how far away from the welding a person must be before he is immune to the effects of arc radiation. The immunity distance naturally varies, depending, among other conditions, upon whether the welding operation is taking place indoors or out. Outdoors, it is generally believed that a person 30 feet away from the arc will not experience any eye troubles even though he may work this close to the arc for long periods. Indoors, it is generally recommended that persons working within a radius of 75 to 100 feet of the welding operation should have their eyes protected with goggles having No. 4 or 5 shade lenses.

Ordinarily, no permanent after-effects result from flashed eyes. However, there have been cases of serious infection caused by home remedy treatment, infections which have eventually resulted in blindness. Because the symptoms frequently develop after hours when doctors are not available, the proper first aid treatment should be known to every worker. The treatment is completely simple: a few drops of sterile oil or a 10% solution of argyrol plus light bandages or opaque glasses. Complete rest of the eye is important. Naturally, a physician should be consulted as soon as possible. Procrastination of a visit to the doctor when the eye is involved is a sure way to invite trouble.

"Weldor's Eye Disease"

Pacific Coast shipyards have recently experienced a disease which has been given the name of "weldor's eye disease" because it first appeared among the weldors. This disease, however, is in all probability caused by a virus and has nothing whatever to do with welding. It was apparently brought to the West Coast from Hawaii, and it has been extending itself eastward.

The condition known as weldor's eye disease will last from several weeks to six months; the average time lost from work has been about 18 days. It usually affects only one eye and is not necessarily serious. As yet, there seems to be little that can be done in the way of treatment. Strict isolation of victims so that they will not contaminate others is apparently the best protection. A physician, of course, should be consulted for the best local treatment—this applies to any eye infection.

Courtesy, Westinghouse

Fig. 5—Cleaning stations should be conveniently located throughout the welding plant, so as to prevent a pronounced drop in eye efficiency because of dirty goggles.

Conclusion

Despite the many hazards apparently at hand to damage weldors' eyesight, little actual harm is done. By developing adequate protective lenses, modern science has removed whatever danger that might be inherent in the occupation. Medical authorities have investigated the effects of welding upon the eyes and have been unable to find any indications of visual deterioration or other ocular damage that might occur as a result of working as a weldor. Periodic eye examinations made by organizations employing many weldors tend to substantiate this fact. It is of the utmost importance, however, that the protective methods are not neglected.

Today, Uncle Sam needs every industrial worker and every civilian as fit as a fiddle. He needs sharp eyes that will see all the way to victory.

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High Frequency Tool Brazing

Tool production may be speeded by a new 500,000 cycle induction heating method for brazing carbide tips to carbon steel shanks.

To lend impetus to the use of high frequency induction equipment for the brazing of carbide tools, the Carboloy Co., Inc., Detroit, and the General Electric Co. announce a new line of 500,000 cycle electronic oscillators. These are available in two sizes—5 kw and 15 kw ratings. The 15 kw is designed to accommodate larger sizes of tools and to permit brazing two or more tools at a time, while the 5 kw unit is designed primarily for smaller sizes of tools.

Other Equipment

In addition to the oscillator, the only equipment actually required, Fig. 1, is a table carrying a tool-holding fixture or fixtures and the necessary water-cooled coil or coils. The coils, electrically connected to the oscillator terminals, are simple to fabricate and may be formed in a few minutes' time from ordinary copper tubing when special brazing requirements arise.

As shown in Fig. 2, the coils may take a variety of forms: cylindrical, box, conical, single and double "pancake," etc., depending on the type of tool to be brazed and the distribution of heat desired. Where the unit has sufficient capacity, it is also possible to use several coils in series so that two or more tools can be brazed at one time. Recommendations as to size of units, coil designs, time cycles, etc. on the basis of the individual user's needs may be obtained from the Carboloy Co., which has established an engineering service to study such problems.

Any suitable brazing medium, including copper and its alloys, may be used for the induction brazing of carbide tools. Advantages cited for this method are:

Convenience. The brazing technique is simpler than when either furnace or torch brazing is used.

Speed. Heating is confined to the actual area desired. The time required to braze a tool is cut from minutes to seconds.

Simplicity. With induction equipment, unskilled labor can be used to braze carbide tools.

Automatic control. The amount of heat and its distribution can be accurately controlled, preventing incomplete brazes or cracking of tips due to localized overheating.

Lower operating cost. One hundred average tools can be brazed for a total power cost of less than 10 cents. There are no furnaces to preheat. Less brazing material and less flux is required in induction brazing than in other production brazing methods.

Fig. 1—Induction brazing a cemented carbide tool with the new electronic equipment now commercially available.

There is no scale formation and hence a neutral atmosphere is not required, even for copper brazing, except when silicon-manganese steel shanks are used.

Maintenance is reduced because there are no moving parts subject to wear.

While considerable power is passed through the heating coils, there is no danger involved because of the nature of the high frequency currents.

For a given size of tool, the same dial settings with the same coils will always produce exactly the same amount and distribution of heat, insuring consistent brazing results.

Simple Operation

With complete instructions as to coil types and time cycles furnished, the operator needs merely to attach the correct coil for the tools to be brazed, set the control dials on the oscillator to the proper current and time values and push a button. The equipment will take care of the rest.

Experience has shown that it is not necessary to "puddle" a tip while it is being heated. Usually, it is only necessary to "seat" the tip with a rod after the current is off and the tool has been removed from the coil but while the brazing material is still liquid.

The shank heats faster than the tip because of higher magnetic properties. Just before the correct brazing temperature is reached, however, it will be found that the carbide tip has caught up to and passed the temperature of the shank. This is a desirable feature since maximum brazing effectiveness requires a slightly higher temperature for the carbide than for the steel.

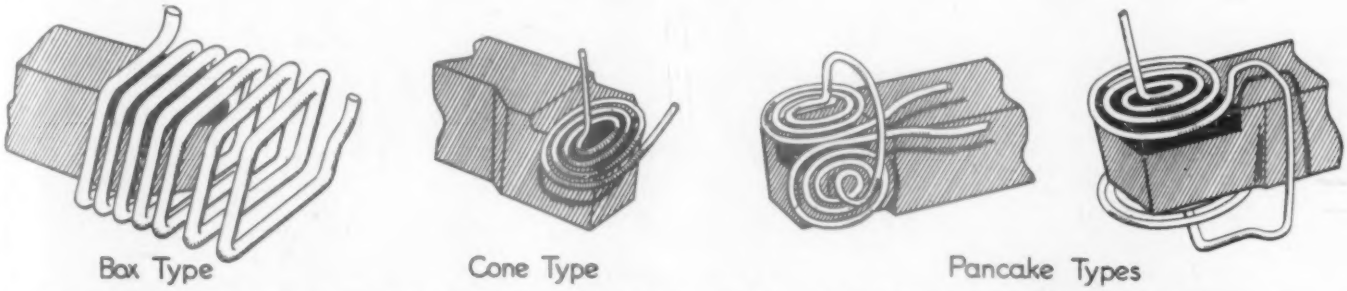


Fig. 2—Typical coils illustrating the variety of different designs which may be applied to the electronic tube induction brazing of carbide tools.

Gas Welding Copper Plate

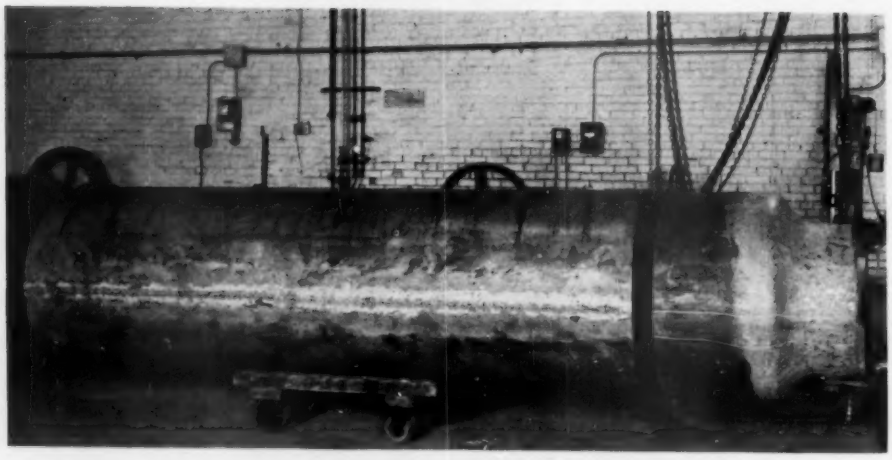


Fig. 1—Welded copper shell and reducer section made of ½ in. rolled plate, 12 ft long by 44 in. diam. The weld on the reducer has been chipped and ground and is ready for a second X-raying.

After extensive experimentation in refinements of procedure, remarkable success in the oxy-acetylene welding of heavy copper plate has been achieved at the Matt. Corcoran Co., Louisville, Ky. Previously, the welding had sometimes been accompanied by cracking, by inability to withstand forming operations or by brazes resulting instead of a weld. These difficulties have all been eliminated by careful training of operators and application of the procedure described below.

Good Alignment Essential

The first requirement in fabricating a large cylindrical vessel such as that shown in Fig. 1 is to make certain that the rolling is as near perfect as possible. Hammered edges usually warp out of alignment when heat is applied. When edges are rolled to good alignment, however, proper use of the preheating flame will maintain their alignment.

In preparing for welding, the edges are first cleaned thoroughly about 3 inches back and fluxed evenly. Small clamping strips are placed at equal distances, as shown in Fig. 2, and the cylinder is stood on end beneath pulley blocks supporting the operators' welding platforms. As welding progresses, the clamping strips are removed.

A small platform is lowered inside the shell so that two weldors—one

Fig. 2 (left)—Welding the longitudinal seam. The outside weldor has a helper, seated on a wing of the platform, who handles a preheating torch and raises the platform progressively. A second weldor on another elevating platform inside the shell keeps pace with the outside operator.

Fig. 3 (below)—Close-up of welding and preheating. Once welding has started, there is no need for any interruption until the top is reached.

Tanks and other large vessels of heavy copper plate are torch welded successfully through a refined procedure. Both longitudinal and circumferential seams are simultaneously welded by inside and outside men.

By **O. J. STONECIPHER**
Matt. Corcoran & Co.

inside and one outside—may work simultaneously. Teamwork among these operators is important. Since oral communication is virtually impossible during welding, the men work by signals between the inside and outside weldors and between the outside weldor and his helper, who handles a preheating torch and raises the platform progressively. The inside operator must be able to maintain the same speed as the outside man while he is taking care of his half of the job.

Interruptions Avoided

Interruptions to welding of this nature are costly and sometimes result in unsatisfactory welds. Hence an ample supply of prefluxed welding rods is prepared in advance so that the welding can proceed without interruption. Likewise, a continuous and adequate supply of both oxygen and acetylene must be assured before the work of welding is started. In this shop, these essentials were met by the installation of two large acetylene generators and a 20-cylinder oxygen manifold. The latter may be seen in the background of Fig. 5.

Welding is started at a point about one third up from the bottom and progresses upward at a rate of about 32 inches per hour. This speed is considered very satisfactory, particularly since it is maintained constantly over the two thirds distance from bottom to top. Preheating is done intermittently by a helper with a multiflame heating torch. A close-up of welding and preheating is shown in Fig. 3. Fans on the weldor's platform blow welding fumes away.

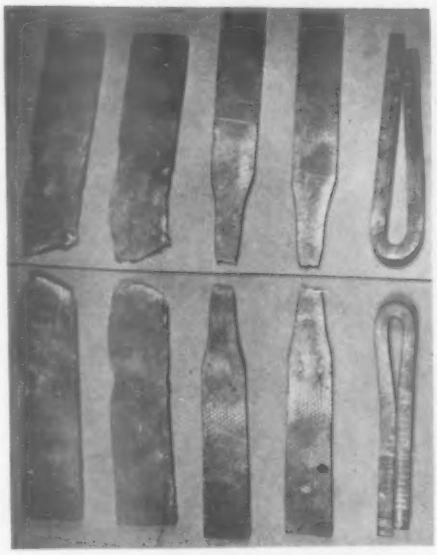


Fig. 4—Qualification test coupons after impact, tensile and bending tests.

Circumferential Seams

When the top is reached, the shell is inverted and the remaining third of the joint is welded. Procedure for welding the circumferential seam is very similar except that the shell is rotated horizontally during welding. The inside operator rests on a stationary platform which projects out beyond both ends of the shell and is supported at a convenient height.

X-rays tests on welded half inch plate were highly satisfactory, showing few or no flaws. Sections of shell formed to reduced diameter, as in Fig. 1, showed only a few surface cracks. These were repaired by chipping and rewelding, care being taken in pre- and postheating of these repairs to avoid aggravating the condition. X-rayed a second time, the areas showed complete elimination of flaws.

Tensile and Other Tests

Qualification test coupons welded by the foregoing procedure showed good grain structure and under tensile test gave a reading of from 28,500 to 31,000 psi ultimate strength. Elongation was from 25 to 28%. Specimens subjected to the nick-break test required severe blows and pronounced deformation before fracture resulted.

An examination of Fig. 4 reveals the quality of the welds and tells why such welds held up in flanging operations in which the copper shells were flanged out 4 inches. Other types of welded copper vessels appear in Figs. 5 and 6.

A factor of particular importance in securing high quality copper welding of this nature is the careful selection of operators. Men chosen for this work should be of the type who strive constantly to improve the quality of each weld and to understand and overcome difficulties as they arise without being discouraged by them.

* * *

Acknowledgment is made to the Air Reduction Sales Co. for the photos reproduced herewith.

Fig. 5—Formed and welded blending vessels. The 20-cylinder oxygen manifold may be seen in the background.

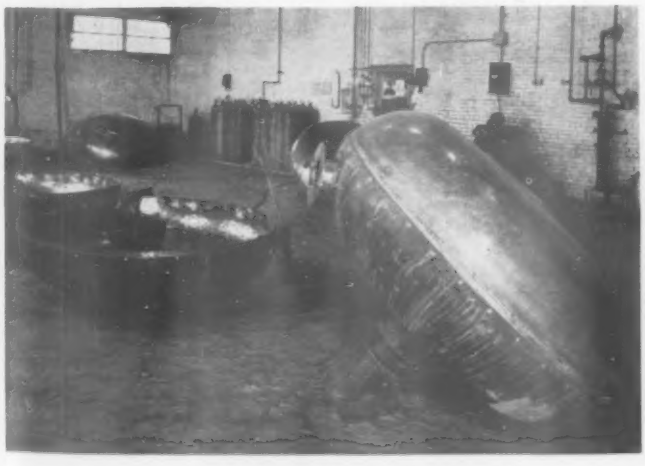


Fig. 6—The circumferential welds on these copper vessels were also made by simultaneous inside and outside welding.

Welding for Civic Maintenance

Three examples from two cities show how municipal street departments now use welding to meet wartime shortages in man-power and materials. These cities are saving money, too, by turning to welded fabrication.

Fig. 1—Welding results in an improved trash receptacle at a lower cost. These trash containers are 21 in. square and 42 in. high and are fabricated from 16 gauge steel.

CIVIC PRIDE demands that city property be maintained despite material and man-power shortages and other present day difficulties. In some instances, however, these difficulties have actually worked to the advantage of the municipal government and to the taxpayer. Materials and supplies which were purchased before the war on a competitive bid basis have been supplemented by improved products at a lower cost—primarily due to the ingenuity of certain city departments and to the judicious use of welding.

Fig. 2—This tar kettle was built by a street maintenance crew at less than half what it would cost if purchased outside.

Welded Trash Cans

The trash receptacle shown in Fig. 1 is a striking example of this new trend. Until recently, the City of Kansas City, Mo., was accustomed to buying these cans for its street corners at a cost of from $22 to $26 each. The cans purchased at this price were fabricated from light gauge steel (approximately 20 gauge) by joining the corners with a lap joint or the tin smith's crimp—similar to the method employed in stove pipe construction. Naturally, a can of such construction was rather fragile for the severe use it received in service.

Finding itself unable to buy additional containers of this type, the City's street department began to fabricate its own trash cans by arc welding. To the surprise of everyone, the cost was less than $10 apiece—including materials, welding and paint. Welding also made it possible to use a heavier metal. The new containers are now made of 16 gauge steel and are, consequently, longer lived and much less subject to damage and denting.

Numerous other savings have been made by this street department. The 400 gal tar kettle shown in Fig. 2 is 36 in. in diam and has an overall

Fig. 3—What happens when an automobile meets a cast iron street lighting standard.

height of 5 ft. By building this kettle in its own shops, the street department found, the cost would not exceed $25. The former price when purchased outside was approximately $60. Other uses of welding include the fabrication of cans for push carts at 50% of their former cost and the maintenance of trucks, snow plows and similar equipment by the speedy repair of broken or worn parts—all at a major saving.

Broken Lighting Standard

Kansas City, however, is not alone in using welding as a means of reducing city operating costs. Another example is given by Fig. 3. The cast iron street lighting standard pictured was smashed to the well known smithereens. Fig. 4 shows how neatly the city maintenance men of Grand Rapids, Mich., put this jigsaw puzzle together. Again, welding came into the picture to save money; the cost of the welding job was only one fourth that of a new standard.

These are only a few of the many examples which might be cited to show how American municipalities are using welding to meet wartime material and man-power shortages.

* * *

Acknowledgment is made to the Lincoln Electric Co. for Figs. 1 and 2 and to the Westinghouse Electric & Manufacturing Co. for Figs. 3 and 4.

Fig. 4—Welding quickly and easily reclaimed the broken standard shown in Fig. 3.

★

Pass the Salt!

SUMMER is here! And when hard work and long hours are added to summer weather, it usually means increased perspiration with an accompanying increase in loss of salt from the body. This is the reason for "that tired feeling" since fatigue increases as the normal salt balance of the body is reduced.

The effects of salt losses upon a worker's physical condition were not generally known until 1932 when a group of scientists of the Harvard University Fatigue Laboratory investigated the cause of the death of a number of workers at Boulder Dam. They attributed these deaths to "heat cramps" which could be traced directly to the loss of salt from the body due to excessive perspiration.

Heat cramps may or may not result in heart exhaustion and are generally without any serious aftereffects. The pain experienced during an attack, however, is sufficiently severe to warrant taking all possible precautions to prevent this illness from occurring. The ways to prevent heat cramps are in some extent the same as those for preventing heat exhaustion.

May Lose 6 to 8 Quarts Daily

Heavy exercise at abnormally high temperatures is one of the main causes of cramps. In the average individual, 74% of the heat of the body is released by radiation, conduction and convection from the skin, 14½% by evaporation and 7% by vaporization from the lungs; practically all the remainder is expired by air. When a person is at rest, the normal water loss through perspiration is about a pint a day. As exercise is increased under abnormal temperature conditions, this loss may run as high as 6 to 8 quarts a day. Under such conditions, the normal water intake may fail to compensate for the abnormal loss of body fluid. As the condition continues, salt is lost from the body, and a series of chemical or physical changes take place, bringing about a state of dehydration, exhaustion and fatigue. When this occurs, it is essential that the lost salt be replaced, or suffering from heat cramps is likely to result.

There are several means by which salt may be taken into the body. The most convenient way of maintaining the body's salt supply is, of course, salting the food at mealtime. This method, however, is not too reliable; though many people have a taste for considerable salt, others desire very little and will not change their normal eating habits because of the advent of hot weather.

A better way is to add salt to drinking water. A concentration of 0.1% to 0.5% is usually satisfactory. The use of salinized drinking water, however, should be under the supervision of the medical department. One disadvantage of using salt in drinking water is that the salty water cannot be used for industrial purposes or where likely to affect a water pipe.

Salt Tablets Convenient

A convenient form for insuring employees an adequate supply of salt is found in the use of salt tablets for employees to take with their drinking water. The tablets should be placed in a dispenser near the drinking fountain so that the employees may use them as recommended by the salt manufacturer. As all tablets do not contain the same amount of salt, the recommendations of the manufacturer as to the number of tablets to take should be strictly followed.

Employees need not worry about getting too much salt in their systems because the body does not store salt. Persons afflicted with heart diseases or high blood pressure should not use the salt treatment except on the advice of a physician; these persons, however, are not usually engaged in activities involving hard work and abnormal temperatures. The only ill effect which might be specifically attributed to salt is a gastric irritation which may be produced when salt is taken in a concentrated form on an empty stomach. Medical authorities, however, advise the liberal intake of salt wherever the character of the work is fatiguing and whenever heat is causing excessive perspiration.

Champion Woman Weldor

Like a boxer, the modern working miss spars it out on the welding table to determine who should be the U. S. Champion.

"The Winnah!" Pretty, blue-eyed, 19-year-old Vera Anderson is an ex-waitress who had never handled a torch or a welding electrode until eight months ago. She is shown here with her welding superintendent, W. B. Bowen, resting between "rounds" on one of the welders used in the intercoastal contest.

One of the most unusual contests ever held for women recently took place at the Ingalls Shipbuilding Corp., Pascagoula, Miss. This was a contest to determine the champion woman weldor for 1943.

Plans for such a contest date back to February when the Ingalls Yard selected Miss Vera Anderson, a weldor of eight months' experience, as the yard's champion woman weldor. Her weldorette opponent was Mrs. "Billie" Hermina Strmiska from the Oregon Shipbuilding Co., Portland.

The two met in a roped off "ring" in the Ingalls Yard where the girls fought it out on flat, vertical and overhead welding while "seconds" and spectators looked on. In this match Mrs. Strmiska was seconded by her husband (and also welding instructor), who is likewise a weldor at the Oregon Shipyard.

While the rules were not those of the Marquis of Queensbury, they were, in their own way, just as complete. The contest was divided into three parts as follows:

Part 1: $\frac{5}{16}$ in. horizontal fillets, 14 in. E-6020 electrodes. Single-pass welds at 225 to 325 amp furnished by a 500 amp A-C transformer.

Part 2: $\frac{3}{8}$ in. vertical fillets, $\frac{5}{32}$ in. or $\frac{3}{16}$ in. E-6010 electrodes (each operator may choose one or the other of these sizes for each pass). Not less than two passes were required for a weld. Welding current furnished by a 400 amp D-C motor-generator set.

For $\frac{5}{32}$ in. electrodes, 130 to 165 amp.

For $\frac{3}{16}$ in. electrodes, 165 to 225 amp.

Part 3: $\frac{3}{8}$ in. overhead fillets, $\frac{5}{32}$ in. or $\frac{3}{16}$ in., E-6010 electrodes (size as chosen by each operator). Number of passes not less than two. Current furnished by a 400 amp D-C motor-generator set; current must fall within the ranges stated for Part 2.

The work of each contestant was judged upon the following points separately: (1) speed, (2) quality and (3) economy of electrode consumption. Their relative scores were determined by the average of the scores for each of the three points. Speed and quality counted five times and four times as much, respectively, as economy of electrode consumption.

Speed was measured with stop watches, starting at the instant when the contestant began welding on any pass or layer. The time ran constantly until the pass was completed throughout the entire length of the specimen and included time spent in changing electrodes and other interruptions on the part of the operator. Between passes, however, there was time out, while the weld bead was cleaned and wire-brushed by helpers appointed to do these tasks for each contestant.

The quality of work was determined by a careful examination and inspection by the judges, who were not permitted to know whose work they were inspecting. If, in the opinion of a judge, the work being inspected passed all of the requirements of the American Bureau of Shipping, he was instructed to enter on his ballot a score of 100 for the piece. If he found defects such as undercutting, convexity, overlapping, etc. which prevented the work from conforming to the requirements, he was to assign the score which in his opinion reflected the relative value of the quality.

For computing the electrode economy score, the total weight of the electrode used by each contestant for each piece of work was determined accurately. In determining this weight, no credit was allowed for stub ends except where an appreciable length of electrode was left over after welding any work piece. The weight of the remaining electrode less two inches was credited to the contestant.

Miss Anderson was an easy winner, taking two of the three rounds. The results, "round by round," are tabulated in Table I. The winner's victory netted her $350 in war bonds, a massive silver cup, a week-end trip to the White House in Washington and the title, "Queen of the Welding World."

Table I. "Round by Round" Score

		Vera Anderson	Hermina Strmiska
VERTICAL	Speed	(W) 15 min, 2 sec	15 min, 5 3/5 sec
	Quality	(W) 96½%	95%
	Rod used	1 lb, 3½ oz	(W) 1 lb, 3¼ oz
OVERHEAD	Speed	*12 min, 35 3/5 sec	7 min, 56 1/5 sec
	Quality	98%	55%
	Rod used	13 oz	9½ oz
FLAT	Speed	(W) 9 min, 44 2/5 sec	14 min, 4 2/5 sec
	Quality	(W) 95%	92%
	Rod used	2 lb, 7½ oz	(W) 2 lb, 6½ oz

Merits: speed, 50%; quality, 40%; rod consumption, 10%.
(W) indicates Winner

*On the overhead test, Miss Anderson made the standard slightly convex, full-dimensioned weld, whereas Mrs. Strmiska made a convex, underdimensioned weld. If the race had been tied for vertical and flat, it would then have been fair to disqualify Mrs. Strmiska for the overhead. However, as Miss Anderson won both the vertical and flat, which gave her the best 2 out of 3, it was unnecessary to call for the disqualification of Mrs. Strmiska's overhead.

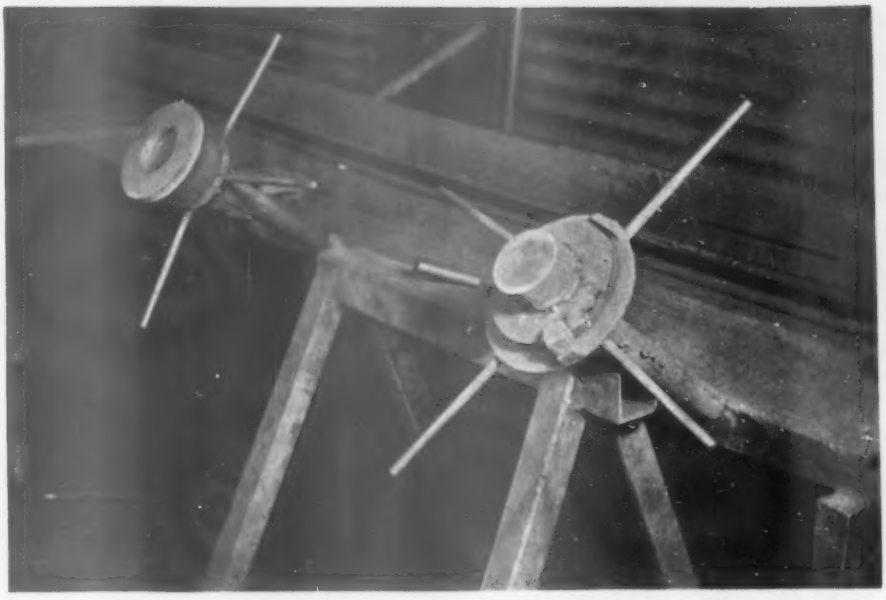


Fig. 1—Jig designed for continuous downhand welding on a preheated pinion. The pinion is held on a disc that turns within the pipe.

Building Your Own Fixtures

With ingenuity, simple yet durable and wholly satisfactory welding jigs or fixtures may be designed to permit faster, more economical production. Such fixtures may be used for handling either large or small parts or for preheating and other purposes.

By **GENE JOHNSON**

Weld Specification Engineer,
R. G. LeTourneau, Inc.

OFTENTIMES, it is necessary to have some special welding fixture "right now," and delay in getting it would prove costly. But this special fixture may be of such a nature that standard structural shapes, a welding machine and a handful of electrodes could produce the desired equipment in a few hours. Instead of scurrying frantically around trying to secure it outside, why not try the "build it yourself" plan? This procedure has frequently been very satisfactory for others, and it is nearly always inexpensive.

Think It Out First

Regardless of the size or type of fixture, the basic requirements and applications of the finished product should be considered before any designing plans are made. Carelessness in the consideration of these principles will show up in the final cost sheet.

Jigs are usually divided into three classes: stationary, hand-operated and power-operated jigs. The first thing to consider is the class that will be most suitable for the particular job in mind. Stationary jigs have their advantages, but they are not always adaptable to downhand welding. Hand-operated jigs range from simple to more complicated designs, but most types are usually designed for downhand welding, increasing production and cutting the cost of the finished product. Since these jigs are, consequently, the most popular, the contents of this article will be largely devoted to the general description of the second type of welding fixture.

Clamping devices on the stationary and hand-operated types of jigs are usually of the C-clamp design, toggle clamps, wedges, bolts or dowel pins. The human element must be considered, in many instances, when demanding exact and true alignment.

The third type of jig may be either electrically or pneumatically operated, depending upon existing conditions and facilities. Naturally the cost of such a machine will be higher, but the resulting increased production should offset this expense. It is, therefore, a question of determining whether or not the expected increased production will justify the additional cost of the power-driven jig. If it does, by all means buy it!

There are many excellent types of power-driven welding positioners on the market today—some capable of handling loads as great as 20 tons. The contribution of these devices to the speeding up of our war effort has been invaluable.

Jig for Circular Welds

In Fig. 1 is a simple hand-operated jig for continuous downhand deposition of two circular welds (one on either side of the flange) on a preheated pinion. The legs and cross member of the stand were formed from structural angles welded together in box shape. A length of pipe was welded on either end to hold a detachable mandrel. The mandrel was fabricated from a heavy disc, a short length of round bar stock being welded to the underside to serve as a pivot for turning inside of the pipe. Stop lugs were welded to the edge to hold the pinion in place, and 5/16 in. round bars were tack welded to the

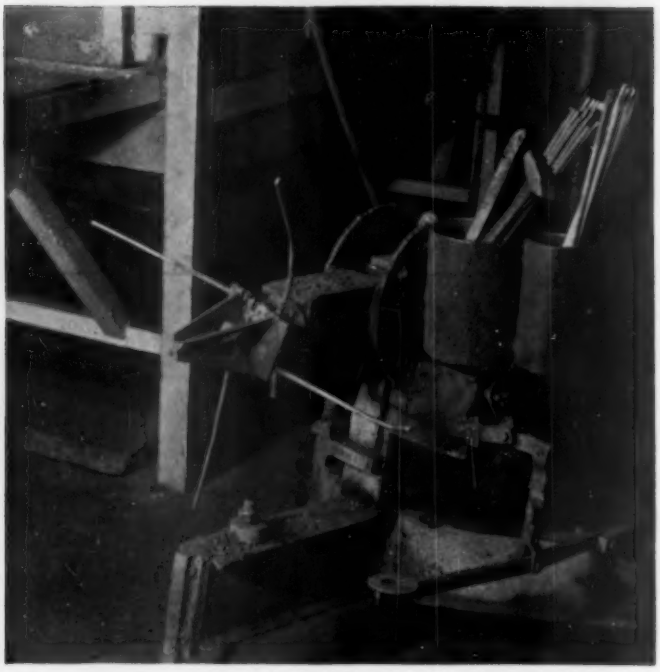


Fig. 2—This jig is hand-turned but foot-locked at any desired angle for position welding.

disc to facilitate turning, as may be seen in the illustration.

Hand and Foot Operated

The jig shown in Fig. 2 was designed for combined hand and foot operation. Structural parts were again employed for this fabrication. Structural channels form the base or leg sections, and two 3 in. angles were welded into a box section to form the upright post. The spindle housing was fabricated with bearing plates at either end. The foot control lever locks the disc and spindle housing section at any desired angle for position welding.

The detachable mandrel may be turned 360 deg. The turning levers were made from 5/16 in. round bar stock. Containers welded to the fixture place electrodes, slag hammer and brush within easy reach of the operator.

No clamping devices are needed in this particular fixture as the weight of the welded structure makes for a snug, tight fit. All welding is deposited in downhand position, thereby increasing production. The heat distribution from preheated parts is equalized by the heavy material used in the jig design.

A Turning Wheel

Fig. 3 is of the same general construction as the jig in Fig. 2, but the spinning mandrel's turning facilities were much improved by rolling the round bar stock into the form of a loop, which was welded to bars jutting from the jig housing. A lock screw is conveniently located within the operator's reach. With this jig, small circular welds are quickly and easily deposited in the downhand position, again reducing the cost of fabrication.

Simple Fixtures Are Best

The three jigs illustrated incorporate all of the basic requirements for shop-made fixtures. Simplicity should first be considered. Complicated designs are usually unnecessary unless the set-up and welding is done in the same fixture.

Convenience in reaching the welded surface plus visibility are two important factors to remember. The jig will be of little practical use if it is difficult to see or get at the work.

Durability shouldn't be overlooked. Make the jig strong enough and rigid enough to hold up under continuous use and withstand deflection. It is often necessary to draw a nice balance in order to prevent the jig from becoming either too cumbersome or too flimsy.

Heat Control Important

Allowances for heat control must be made, otherwise there will result misalignment, buckling or overlapping of the parts. Always construct the jig so that it carries heat *away* from the weld.

Clamping pressures will depend largely upon the type of structure being welded. Usually, simple toggle clamps, C-clamps or wedges are sufficient to hold the alignment.

Storage facilities must also be considered. If necessary, design the jig in sections for demounting and storage. Paint or stamp part numbers or names as a convenience for relocating the sections when they are in the storage racks.

The cost of a jig must be considered on the same basis as any new equipment. Estimate the savings in terms of increased production, and decide how much future use the jig will get. Simple arithmetic will then tell you whether or not it will pay for itself in a reasonable length of time.

Facility in constructing jigs to meet specific requirements can be acquired only by experience. With each succeeding design, improvements and new ideas will follow. Results will be measured in terms of your ability to meet continued demands for the increased production so vitally needed.

Fig. 3—Use of a wheel instead of turning bars has greatly facilitated the rotation of the spinning mandrel.

NO. 6 OF A SERIES

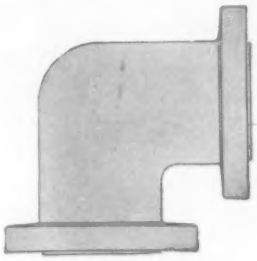
HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

Weight saved* with Tube-Turn Welding Fittings aids war industry—by economizing steel, speeding pipe erection, conserving supports, reducing shipping weight.

**Tube-Turn fittings in comparison below are 6", Schedule 80. Other fittings are 6", 600 lb. class.*

FORGED FLANGED ELBOW



450 lbs.

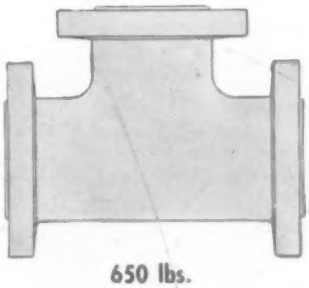
CAST STEEL FLANGED ELBOW

250 lbs.

TUBE-TURN WELDING ELBOW

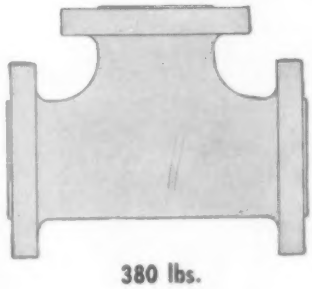
33½ lbs.

FORGED FLANGED TEE



650 lbs.

CAST STEEL FLANGED TEE



380 lbs.

TUBE-TURN WELDING TEE

80 lbs.

THE examples illustrated above demonstrate the tremendous differences in weight between Tube-Turn welding fittings and other types of steel fittings. These comparisons are for 6" size (see note above), and other sizes are more or less proportionate.

Weight saving *always* has been an important reason for specifying Tube-Turn welding fittings. But today's war production needs stress additional advantages of this feature. It saves steel—because less of this strategic metal is required in making Tube-Turn fittings. Piping systems welded with Tube-Turn fittings are *lighter* and *streamlined*—which speeds erection, saves space, and simplifies structural problems. Remember these timely points when you buy or specify fittings for oil, gas, power, chemical, heating, air, refrigeration and marine piping today!

OTHER WAYS TUBE-TURN FITTINGS HELP WAR PRODUCTION:

SPEED INSTALLATION: Less time needed for aligning thanks to true circularity and uniform walls. Only simple butt welds required, easy even for novice welders. Whole section can be preassembled on the ground.

SAVES SPACE: Tube-Turn fittings permit streamlined, compact layouts and sharp angles—neater, more efficient piping.

REDUCES MAINTENANCE: No gaskets to replace, no nuts or bolts to tighten. Maintenance practically eliminated. Relieves men for other duties.

AVOID SHUT-DOWNS: Practically no danger of shut-downs due to connection failures as welding with Tube-Turn fittings eliminates the chances of leakage.

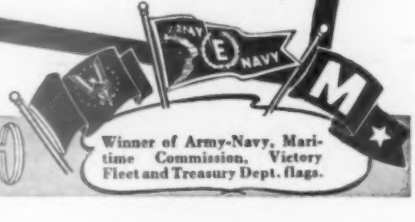
INCREASE SAFETY: Exclusive manufacturing process gives greatest possible strength in fittings, full freedom from leakage, and longer life in piping systems.

TUBE-TURN

TRADE MARK

Welding Fittings and Flanges

TUBE TURNS (INC.) LOUISVILLE, KY. ● *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, Los Angeles. ● *Distributors in principal cities.*

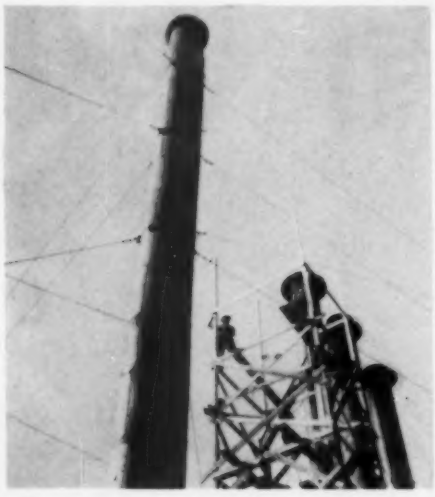


Winner of Army-Navy, Maritime Commission, Victory Fleet and Treasury Dept. flags.

On the Job

Welded Boiler Stacks

ALL-WELDED construction materially speeded the erection of two 150 ft boiler stacks urgently needed by a large southern manufacturing plant. The stacks were erected in one third less time than would normally have been required. The contractors were E. McLaughlin & Sons, Richmond, Va.



Courtesy, General Electric Co.

One of two 150 ft boiler stacks fabricated by arc welding at a southern manufacturing plant.

The stack sections were cylinders 5 ft in diam and 5 ft long, fabricated from ¼ in. low carbon steel plate. During the first 100 ft of installation, two of these sections were welded together in the shop and erected as a single unit. Because of handling difficulties, however, each 5 ft section had to be mounted separately during the last 50 ft of installation.

The shop welding was done with 300 amp motor-driven D-C welders, the field work with 300 amp engine-driven D-C welders. Because of the height of the stacks and their inaccessible position, the engine-driven welders had to be located 400 ft away from the work. Nevertheless, no difficulties in either striking or maintaining the arc were encountered.

The sections were overlapped and the joints fillet welded with 5/32 in. AWS E-6010 all-position electrodes. Approximately 1,200 lb of electrodes were used on the two stacks.

» «

"Impossible" Job

A GROUP of Texans were ordered by the Defense Plant Corp. to produce four 20-ton fuel economizers for a synthetic rubber plant in three weeks. They had no factory, no workmen and no equipment other than a hammer and a chisel. An impossible job, of course. But they completed it in 17 days.

The group, all members of which were experienced in arc welding engineering, organized itself into the M. B. and M. Pipe Fabricating Co., Inc., Houston, Tex. T. K. Mason was named president; his brother W. H. Mason and an associate S. M. Butler were made vice-presidents; Thomas G. Ferrell was named the company's welding engineer, and Tommy McGinnis, welding superintendent.

Practical weldors all, these men were acquainted with a large number of weldors from coast to coast, and they also knew of the existence of a large amount of welding equipment standing idle in garages and shops. They rented a vacant building with a big lot adjoining, cleared the lot, cleaned out the building, rounded up workers and cutting and welding equipment—and got down to business. They worked two shifts daily with a total of 45 men, some of whom brought their own arc welding machines.

Each of the four fuel economizers (see illustration) is 15 ft long and 10 ft in diam at the base, tapering off to 8 ft at the top. Each has 604 two-in. tubes and three fuel sheets, requiring the cutting of 1,812 two-in. holes.

A big job, you bet, but nothing on earth seems to be too big for enterprising Texans! They completed the economizers ahead of schedule.

» «

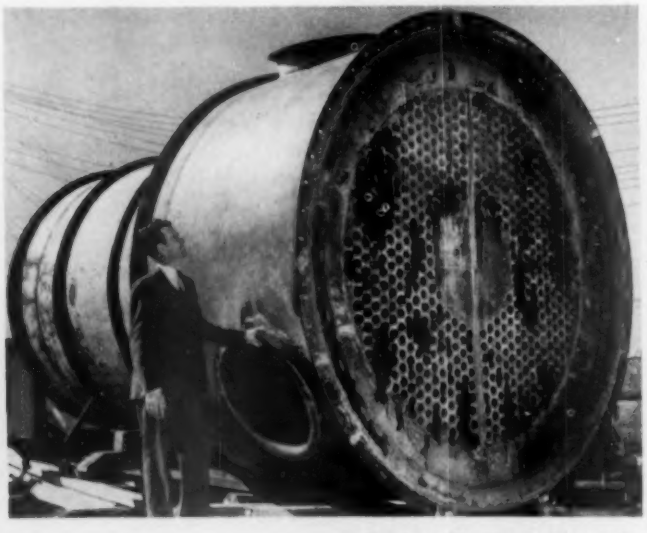
Spot Weld Tester

ORDINARILY, spot welding is tested by "pulling a button"—a method which tells only if the material was welded and fails to give any indication of weld strength or soundness. A small shear testing machine has been developed at the East Springfield, Mass., plant of the Westinghouse Electric & Manufacturing Co. for quick shop testing of both of these weld qualities.

The inspector who desires to make such a test takes two standard test pieces, cleans their surfaces and makes a welded lap joint. The specimen is clamped in the machine and a shear applied. A gauge on the machine registers the force applied in pounds, and a prepared chart shows the minimum strength required for the various thicknesses and types of material.

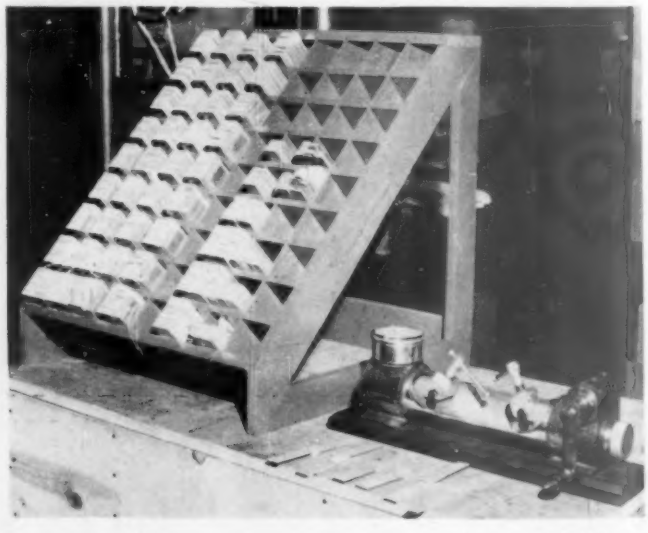
Advantages of the shear testing machine are: (1) it gives a quantitative value of the weld strength; (2) it serves as a quick check on spot welder set-up; (3) it is compact and simple to operate, and (4) it permits tests to be made by an operator or floor inspector instead of a laboratory technician.

Fuel economizer completed in record time for a synthetic rubber plant.



Courtesy, The Lincoln Electric Co.

Shear testing machine and rack for testing spot welded specimens.



Courtesy, Westinghouse

Helping to Solve Today's Wartime Production Problems

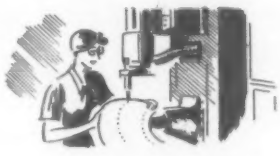
THE SCIAKY PROCESS OF ELECTRIC RESISTANCE WELDING IS MAKING THESE VITAL CONTRIBUTIONS TO OUR MIGHTY FLOW OF WAR GOODS

SAVING PRECIOUS MATERIAL . . . .
by replacing costly riveting methods on many assemblies, spot welding is responsible for saving large quantities of critical metal. Better welding methods mean less rejects and scrap. In addition, the Sciaky method enables two or more machines to operate from the same rectifier, thus saving scarce equipment.

SPEEDING PRODUCTION
As many as 80 spot welds per minute on two thicknesses of .040 light alloy! Primary and secondary assemblies, as well as non-structural parts are being spot welded with speed and precision. The use of extremely short weld timing and precise control of energy make possible this high speed.

LOW POWER NEEDS
The extremely high current requirements for welding aluminum alloys and consequent heavy expense involved for the installation of special conducting equipment, are eliminated by the application of the Sciaky "Stored Energy" principle. Ordinary current is rectified and stored before release to the electrodes.

STRONGER, SOUNDER WELDS . . . .
are effected by the Sciaky patented Variable Pressure Cycle. Precompression to establish perfect contact is followed by a reduced pressure during the welding surge, and finally a recompression which "forges" the metal. A preheating feature makes possible stronger welds by reducing stresses.

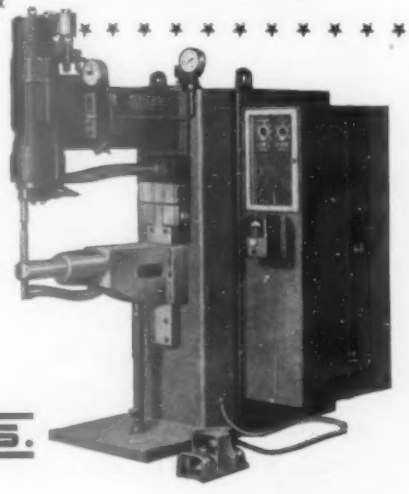


NO SKILLED OPERATORS
Once the proper pressure, current and timing has been set, the operation (by a convenient foot switch) is fully automatic. The settings are easily made on the sequence panel by the adjustment of the maximum current relay and the pressure gauge.

LESS MAINTENANCE
Simplicity of diagram reduces maintenance problems. The control cabinet is hinged and the entire sequence panel may be removed. Routine contactor maintenance may be made by an ordinary electrician. The Sciaky machines are sturdily built, quickly installed and easily qualified.

left
TYPE PMCR.2516 SCIAKY ELECTRIC RESISTANCE ROCKER ARM WELDER, welding 70 spot welds per minute, on two sheets of aluminum alloy of .040" each. Welding capacity from two thicknesses of .016" in aluminum alloys up to and including .080".

right
TYPE PMCO.2516 SCIAKY ELECTRIC RESISTANCE WELDER, 80 spot welds per minute on two sheets of light alloy of .040" each. Welding capacity from two thicknesses of .016" each in light alloys up to .091".



SCIAKY BROS.

4915 WEST 67th STREET • CHICAGO, ILLINOIS

Amsco Welded Crusher Mantles
Help Relieve War Time Scarcity

From an Eastern welding equipment distributor comes the following report:

Worn manganese steel crusher mantles at a Virginia crushing plant were rehabilitated by Amsco conservation welding. One-inch diameter Amsco nickel-manganese steel filler bars were swedged by hand, after heating to a red heat, to match the contour of the mantle and then were tacked on two inches apart, using 3/16" and 1/4" Amsco nickel-manganese steel electrodes. The space between the applicator bars was then partly built up with the same rod. All the welds were peened vigorously.

•

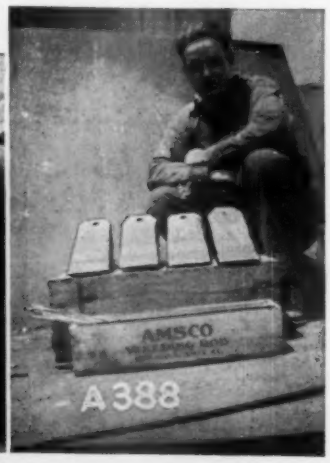
W4—Crusher mantle, 128" at large end, built up with Amsco Nickel-Manganese Steel Electrodes and Amsco Filler Bars.

A388—Dull, inefficient dipper teeth made sharp at small cost with Amsco Repointer Bars and a little Amsco Nickel-Manganese Steel Welding Rod.

The user asserts that the rebuilt mantles lasted as long as new ones, which is credited to the formula of the welding materials and work-hardening from thorough peening. This is another case where build-up welding has restored essential parts to "good-as-new" condition while saving new metal badly needed elsewhere. This work would be justified under war-time conditions even if more expensive than new castings, but usually the cost of reclamation is less.

Amsco nickel-manganese steel welding rod, filler bars and shapes are also conserving metal in reclaiming such castings as crusher jaws and concaves, dipper lips and teeth, and other ferrous parts which are subjected to severe abrasion.

Write for Bulletin 941-W, describing the complete line of Amsco Welding Products.



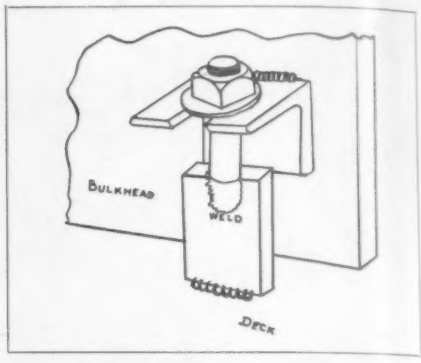
Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois

AMERICAN Brake Shoe COMPANY

FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

Bolt Saver

IN SHIP construction, and particularly for the erection of bulkheads, a large quantity of bolts are tack welded directly to the decks or other members to be flanged in place; these erection bolts hold the bulkhead in position until it can be permanently welded. After welding has been finished, the bolts are removed by the simple expedient of burning off their heads.



Sketch showing construction and use of welded tail bolt. This bolt may be used over and over as long as its threads remain intact.

An idea for the salvage of the beheaded bolts was the suggestion of Elmer Homo, Permanente Metals Corp., Shipyard No. 1, Richmond, Calif., to the War Production Drive Committee.

"Welding a tail on the heads of bolts (see sketch) has resulted in saving a very large quantity of bolts which would have otherwise been ruined under the old system," said Mr. Homo. "At least 80,000 bolts with heads damaged by previous tacking or by burning in the process of removal have been salvaged by the simple expedient of (1) completely burning off the heads and (2) welding extension tails to the threaded shanks of the bolts.

"The renovated bolts may be made to serve as long as their threads remain in good condition simply by trimming off the lower ends of the tails so as to remove the previous tack metal. Other advantages are that the tail requires at least 25% less welding to attach to a plate than was required to secure three sides of a bolt head, that it causes less undercutting of the plate in making the tack and that it may be tacked in positions in which it would be impossible to secure a bolt head. It may also be used as a dog in pulling the shell into the frames; wedges are simply driven between a side of the tail and a frame for fairing up the frame."

» «

Preheating Torch

A USEFUL suggestion for improving the efficiency of a natural gas preheating torch was made to the War Production Drive Committee by W. H. Waters, Northrop Aircraft, Inc., Hawthorne, Calif. Mr. Waters' suggestion was an air mixing chamber based upon the same principle as is used for gas stoves and heaters. The chamber is welded onto a gas pipe at the torch end. It utilizes the oxygen in the air to produce a hotter flame for preheating purposes, its inventor declares.

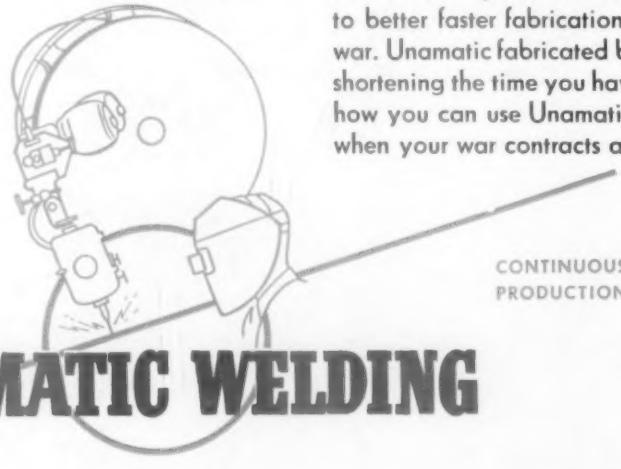
Unamatic Welding Bombs Europe Now—Peace Time Fabrication Next

● Here's a note for history. Among the many elements which brought about the decision to crack Germany from the air a high rating goes to the fact that America had found a way to make bigger bombs faster than anybody had ever dared to hope.

Bombs — both aerial and marine — are being largely fabricated by Unamatic arc welding. Much of the Unamatic equipment going into use the past two years has gone to work on bombs. That's why America is now able to make bombs faster than the planes can drop them.

Circumferential shielded arc welding with Unamatic is the fastest high grade welding known. Down to two inches diameter or six inches straightaway, automatic welding with Unamatic equipment is faster and better and usually costs less than manual operation.

Unamatic equipment now is wholly engaged upon war production. But Unamatic speed and quality will be as important a contribution to better faster fabrication after the war. Unamatic fabricated bombs are shortening the time you have to plan how you can use Unamatic welding when your war contracts are ended.



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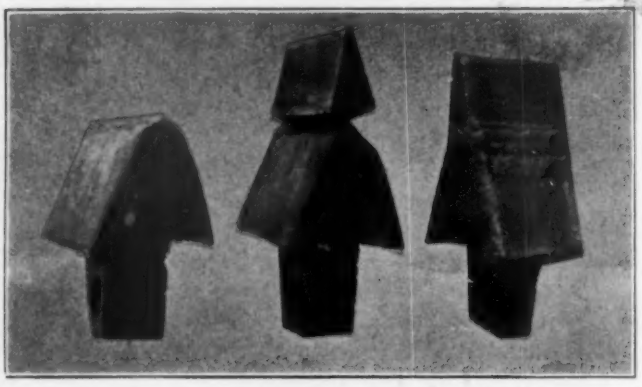
MANGANAL

(Reg. U. S. Pat. Office. U. S. Patents 1,876,738—1,947,167—2,021,945)

11 to 13½% Manganese Nickel Steel

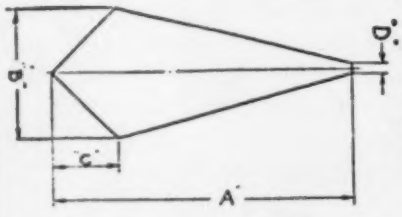
WELDING PRODUCTS

CAST WEDGE BARS



FOR REPOINTING MANGANESE AND CARBON STEEL SHOVEL AND DIPPER TEETH.

At Left—Cast Wedge Bar attached to worn down Dipper Tooth.



Wedge Bars come in 22 sizes to fit any size tooth. Always attach with Manganal Base or Special Tite Kote Welding Electrodes.

One Bead of Seaco hard surfacing over Cast Wedge Bars makes them wear longer. 150 Distributors carry complete stocks.

Sole Producers

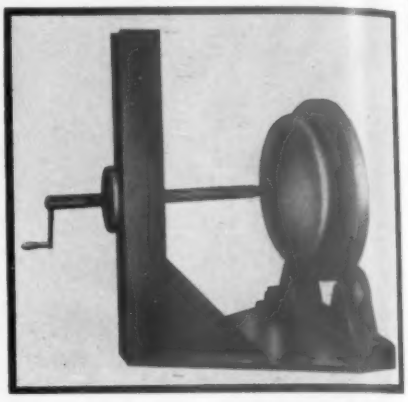
STULZ-SICKLES COMPANY

134-142 Lafayette St., Newark, N. J.

Positioning Bonnets

HEAT exchangers require bonnets with ribs that will give the fluid the required number of passes through the exchanger. These bonnets are fabricated from forged flanges and pressed steel heads.

A simple fixture for positioned welding



Courtesy, Hobart Brothers

Fixture for welding the bonnets of pressure vessels.

of the bonnet heads to flanges is submitted by John S. Green, Cleveland, Ohio. Its construction required: 1 base plate 1¼ by 36 by 48 in., 1 H-beam 6 by 50 in., 1 channel 10 by 48 in., 2 rollers 8 by 3 in., 1 bar 1½ by 28 in., 2 roller bearings. The balance of the material used came from the scrap pile.

The operator will lose little time in setting up this fixture for the different diameters which are to be welded because its pedestals are adjustable on the channel to suit various flange diameters. This adjustment is obtained by welding side guides into position and setting studs in the channel to fit into slots in the pedestal bases. The horizontal supporting bar is threaded and equipped with a suitable locking nut so that the length and height of the bar can be set as required. Adjustment of the height is secured by cutting a slot in the web of the H-beam.

» «

Stud Welding Collet

A PRACTICALLY fool-proof device for the projection welding of steel studs to metal hinges and sheet metal surfaces has been perfected by Andrew Campriello, foreman and spot welding expert at General Electric's Schenectady works.

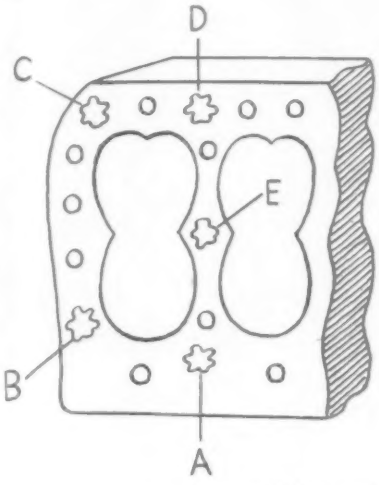
A vertical slot is milled in the stud collet, located in the bottom electrode. When the upper electrode is depressed, the jaws of the collet close tightly about the stud; the resulting pressure causes the current to be distributed evenly on all sides and distributed at the top of the stud near the welding zone.

As soon as welding is completed, the upper electrode lifts and air pressure forces the tapered collet upward. Expanding, the collet releases the stud, thus eliminating the former problem of "binding." The upward movement of the collet is stopped by a set screw as soon as it reaches a height sufficient to release the stud.

Salvaging Cylinder Heads

By HARRY KERWIN

BECAUSE of the chemical action of the water, the water jacket holes in an aluminum cylinder head often become enlarged through severe erosion. Eventually, the head gasket cannot hold back the water, which is allowed to enter the cylinders and destroy the motor's efficiency.



Courtesy, Hobart Brothers

Welding procedure diagram for aluminum cylinder head repair. Welding order is: "A" to "C" to "E" to "B" to "D."

These eroded holes may be filled in with new metal. A simple process of arc welding effects a satisfactory and economical repair for such cylinder heads, which would otherwise have to be scrapped. This repair can be effected at only a small fraction of the original cylinder cost. The detailed welding procedure is as follows:

Place the cylinder head on the welding table face up. With a hammer and a flat chisel, cut away the dirty eroded area around each water hole until the clean metal is exposed.

Grind carbon sticks to the original size of the water holes and insert a stick in each hole to be repaired. This will maintain the correct size of the holes and eliminate the necessity for redrilling.

Preheating is necessary. Brick or other material suitable to exclude drafts should be loosely stacked about the cylinder head, which is preheated with an oxy-acetylene torch using a No. 8 tip. Heat the cylinder head until the chill is gone or until the entire head is warm to the touch. A word of warning: DO NOT OVERHEAT!

Use a ⅛ in. aluminum electrode and a 200 amp arc welder with multiple adjustments. Set the current at exactly 120 amp and the voltage at 20, with reverse polarity.

Commence welding at hole "A" (see sketch). Run one pass completely around the carbon stick, fusing deeply into the cylinder head. It is important to complete each pass without breaking the arc.

Immediately upon completion of each pass, peen the deposit lightly. Peening will avoid stress by counteracting the normal shrinkage of the weld deposit.

After peening the first pass on hole "A," wait two minutes, move to hole "C" and repeat the process. Move in turn from "C" to "E," from "E" to "B," and finally to hole "D," pausing two minutes between deposits. This procedure prevents overheating in any one area and avoids distortion.

If one pass is insufficient to bring the eroded area to the correct level, begin at hole "A" and repeat the entire process, even to warming the cylinder head slightly with the acetylene torch. Each bead must be thoroughly cleaned before the addition of more metal.

After all of the eroded areas have been built up, cover the entire cylinder head loosely and allow it to cool normally for about 45 minutes. The cylinder head may now be dressed by hand with a file or finished in a machine shop. The final result will be a cylinder head as good as new.

» «

Capsule for Hitler

THE little pill shown in the accompanying picture is guaranteed to give Adolf, Benito or Tojo a bad case of indigestion. This shell, though, was a defective forging because the end opening was too large. To save it, arc welding was called in to build up the wall to size. An all-position, high tensile steel electrode having physical properties equal to that of the shell is used for this purpose.

In making forgings, there is not always sufficient material to meet the size requirements; that is why it has been found economical to use arc welding as pictured. Otherwise, the shells with oversized openings would have to be discarded, resulting in a loss of approximately $40 in material costs alone for each rejected shell. The deposition of new metal salvages all of the material and labor costs of the forging.

Courtesy, The Lincoln Electric Co.

This forged shell did not have sufficient material to allow for a right-size opening. By depositing weld metal, the opening is reduced to the correct size, and the labor and material invested in the forging are salvaged.

WESTINGHOUSE WELDERS FOR JOB SHOP WORK

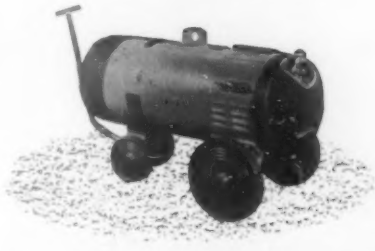
4 ways to better welding

FOR SHOP MAINTENANCE AND LIGHT WORK

Model WT-1C—100 amperes. Current range, 20 to 140 amperes. Built-in capacitor (optional). Built-in breaker protection. Easy to move.

ALL-PURPOSE WELDER

Model WT-4C—200 amperes. 27-step current adjustment from 20 to 250 amperes permits using wide variety of electrodes. Built-in capacitor (optional) and Nofuze "De-ion" Circuit Breaker.



NEW D-C WELDER WITH ARCONTROL

Single, pre-set current adjustment. Lots of capacity to handle all kinds of work. No drop-off after warming up. Simple adjustments. 200, 300 and 400-ampere models.

COMPLETE LINE OF WELDING ELECTRODES

Westinghouse electrodes are designed for fast production of high-quality welds with a-c or d-c on carbon steels, cast iron, stainless and alloy steels, sheet metal and special applications. Strike easily and have high deposition efficiency.

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Write for latest a-c and d-c welding literature. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-21279

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PLANTS IN 25 CITIES... OFFICES EVERYWHERE

WELDERS

MEET THE CHAMPION "BUILDER-UPPER"

When it comes to rebuilding worn parts, Harcote is the real champion electrode that gets in there—puts on a hard surface that's tough and long-lasting. An important time and money-saver, too! When worn parts would take weeks to replace—Harcote does the job quickly—at a fraction of the new part cost—gives you a part that will outwear the original.

Harcote is ideal for welding on carbon steel, low alloy and high manganese surfaces.

See your P&H representative for procedures. Also ask about P&H electrodes for any other welding requirements.

P&H Alloy Electrodes

Also ask for Information on P&H A.C. and D.C. Welders

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A New Star Has Been Added to P&H's Army-Navy "E"

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WASHINGTON, D. C.

Tool-Tipping Procedure

TOOLS DIVISION
CONSERVATION DIVISION

BRAZING

LOW TEMPERATURE

This process is especially adapted to the requirements of high speed steel.

APPARATUS: An oxyacetylene welding torch. A vise or jig in which to hold the tool in a convenient position.

MATERIAL: A silver brazing alloy shim of proper thickness, usually .003" to .008", with a melting point of 1175 F maximum. A flux of a type that will dissolve oxides found on high speed steel, and which will be fluid and active at brazing temperature. A good grease solvent.

PROCEDURE for hardened high speed steels:

1. In joining an inserted tip to a shank, machine or grind a recess in the shank to match the tip.
2. Make sure that the surfaces of both recess and tip which are to be brazed are fairly smooth. A milled surface or equivalent is satisfactory.
3. Clean all surfaces to be brazed with a good grease solvent.
4. Place the shank in the vise or jig with the recessed end projecting.
5. Coat the recess and the tip with flux.
6. Place the shim of silver brazing alloy on the entire recessed surface to be brazed.
7. Place the tip of the shim.
8. Apply heat with the oxyacetylene torch. The flame should be neutral or slightly reducing.
9. Direct the flame to the underside of the shank below the recess, moving the flame back and forth to distribute the heat evenly. Heat the shank until it becomes a barely visible dull red.
10. Withdraw the flame to a greater distance from the work and continue heating until the brazing alloy melts, keeping the temperature as low as possible in order to avoid drawing the temper from the tip.
11. Make sure the alignment of the tip is correct.
12. Press the tip firmly into place. Maintain the pressure until the brazing alloy has solidified.
13. When the brazing alloy has solidified, as determined by eye, immerse the tool in oil long enough to set the braze, then cool in air. The hardness along the cutting edge should be comparable with that of solid hardened high-speed tools.

PROCEDURE for butt joints, etc. In joining a tip to a shank when a notch is not used, such as in the case of a butt joint, the procedure is similar, except that additional care must be taken to make sure that the alignment is accurate.

HIGH TEMPERATURE

This method is used for tipping with annealed high-speed steel.

APPARATUS: A high heat furnace of the type used for hardening solid high speed tools, or for brazing tungsten carbide bits; it is advantageous, although not necessary, to have the furnace of a type in which the heat can be localized on the end of the tool. Also, a preheating furnace is useful; but if not available the required preheat may be applied in the cooler portions of the high heat furnaces.

MATERIAL: For brazing with copper: Copper shims .003/.005 inches in thickness. Brazing flux suitable for brazing with copper. A good grease solvent.

PROCEDURE for brazing with copper:

1. Machine or grind a recess in the shank to match the tip. Make sure that the surface of the tip which is to be brazed is fairly smooth. A milled or ground surface is satisfactory.
2. Remove all grease and dirt with the solvent.
3. Coat the tip and the recessed end of the shank with copper type brazing flux.
4. Place the shank in the furnace, and heat until the flux flows freely. Maintain a neutral or slightly reducing atmosphere.
5. Remove shank and fit the copper shim into the recess.
6. Fit the tip onto the shim.
7. Preheat the assembled tool to about 1600 F in the preheating furnace or in the cooler portion of the high heat furnace.
8. Transfer the tool to the high temperature furnace and hold it at the proper quenching temperature for the grade of high speed (2200 to 2350°), until the tip has soaked out. Soaking time should be kept to a minimum to prevent grain growth.
9. Since the melting point of copper is 1980° F., the copper shim will have melted and spread over the interfaces. Withdraw the tool.
10. Adjust the alignment.
11. Press the tip firmly into place to squeeze out the excess copper and flux.
12. As soon as the copper has solidified, quench the tipped end in oil until the temperature has dropped to below 200 F.
13. Temper the tool at 1000 / 1050 F.

MATERIAL for brazing with ferro-alloy cement: Ferro-alloy cement, copper sulphate, sulphuric acid.

PROCEDURE with ferro-alloy cement:

1. Prepare a flat surfaced recess for the tip. The surfaces to be joined should be fairly smooth. Milled finish or equivalent is satisfactory.
2. Clean surfaces with the grease solvent.
3. Prepare a solution of 3 ounces of copper sulphate and 10 drops of concentrated sulphuric acid, dissolved in one pint of water. With this solution paint the surfaces to be joined.
4. While the surfaces of the recess are still moist sprinkle over them a layer of commercial ferro-alloy cement. Smooth out the layer so that it is flat and about 1/32 of an inch thick.
5. Press the tip firmly into the recess.
6. Set the tool aside for an hour or more. This will affix the tip securely enough to permit handling.
7. Preheat the tool to about 1600 F. in the preheating furnace or in the cooler portion of the high heat furnace
8. Transfer the tool to the high temperature furnace and raise it to the quenching temperature proper for the grade of high speed involved (2200 to 2350 F).
9. Soak out the tip, but keep the soaking time to a minimum.
10. Withdraw the tool and press the tip into the recess to squeeze out excess cement, using foot treadle, or tongs.
11. Check the alignment.
12. When the cement has solidified quench the tool in oil or air until the temperature has dropped to below 200 F.
13. Temper the tool at 1000 / 1050 F.

WELDING

RESISTANCE FLASH WELD

This method is particularly adapted to butt welding a high-speed tip to a simple steel shank, but may also be used for welding a tip to the face of a simple steel shank adjacent to the end, although considerable care is required in this procedure.

It is desirable, for butt welds, that the areas of the sections of the two parts to be welded be as nearly equal as possible in order to avoid disproportionate rates of heating. A difference of 10 percent is the maximum that should exist in applications of this method.

APPARATUS: A tempering furnace. A standard resistance flash welder, manually operated or motor or hydraulically driven, and equipped with changeable copper dies machined to fit the contours of the sections to be gripped during welding.

PROCEDURE for welding hardened high-speed steel:

1. Preheat the parts to be welded to about 1000 F.
2. Clamp the tip or stub in one pair of welding dies, and the shank in the other pair.
3. Make sure the alignment is correct.
4. Weld. The duration of the flash, the pressure, and the amount of upset required for an efficient resistance flash weld are details which can be learned only through experience. Assistance may be obtained from the manufacturer of the welder.
5. Immediately at the conclusion of the weld, place the tool in the furnace at a temperature of 1000 / 1050 F and maintain this temperature for about 2 hours. This will relieve thermal stresses at the welded section. The tool should not be permitted to cool in air from the welding heat.
6. At the end of the tempering period, remove the tool from the furnace and cool in air.
7. Remove and flash and dress the upset.
8. Form the cutting edge.

PROCEDURE for welding annealed high-speed blanks to simple steel shanks, not for subsequent forging:

1-4 as above.

5. At the conclusion of the weld, bury the tool in lime, mica, ashes, or other inert material until cool, to prevent excessive thermal shock.
6. Anneal the tool according to high-speed steel practice.
7. Remove the flash and dress the upset.
8. Form the cutting edges.
9. Harden and temper according to high speed practices.

PROCEDURE for welding annealed high-speed blanks to simple steel shanks for subsequent forging:

1-4 as above.

5. From the welding temperature, cool the tool in lime, ashes, or other inert material.
6. Anneal the tool according to high-speed steel practice.
7. Forge. Then cool in lime, ashes, etc.
8. Anneal according to high speed practice.
9. Form the cutting edges.
10. Harden and temper according high speed practices.

MECHANICAL TOOL HOLDERS

Tool holders are well adapted to the requirements of high-speed steel. They are designed to hold cutters for lathe and planer tools, and consist of a simple steel shank with a recess through one end, into which a cutter is inserted. The cutter is held in place by a set screw. Thus, a relatively small inserted cutter replaces the high-speed steel content of a solid tool.

Although tool holders are made in a number of shapes for various operations, and in a wide size range, they are particularly useful from a conservation standpoint in sizes below about ½ inch. This is because the various brazing and welding methods of tipping are not economically suitable to sizes under ½ inch.

Further details, including sizes, types, and applications of tool holders may be obtained from manufacturers.

PRESSURE WELD

This method is suitable for jointing high-speed stubs to simple steel shanks. The minimum size that can be welded economically is about ½ inch.

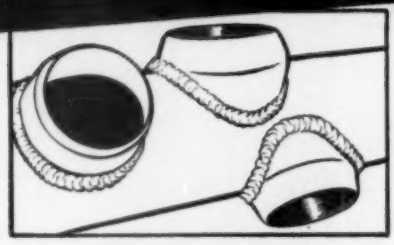
APPARATUS: Manual, mechanical, or hydraulic pressure machine that can apply 4,000–4,500 lb. per sq. in. of pressure. Pressure gauge capable of measuring twice this pressure. Alignment holding jigs. Heating apparatus, variable with size and shape of cross section to be welded, providing for oscillation of flame through a short distance above and below weld section. Auxiliary furnace capable of attaining temperature of about 1650 F for slow-cooling welded piece.

PROCEDURE:

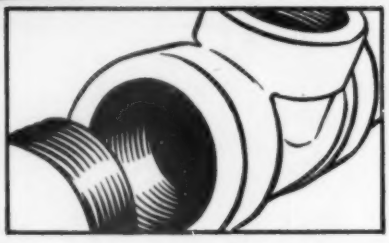
1. Smooth cut sections to be welded. A smooth machine finish or equivalent is satisfactory. The cut must be perpendicular to the length of the pieces.
2. Secure the high-speed stub and simple steel shank end to end in the welding apparatus.
3. Apply an initial end pressure of about 1,000 pounds per square inch of joint cross section.
4. Ignite the gas in the heating head. Adjust the flame to a neutral or slightly reducing ration.
5. Oscillate the heating head across the weld interface through a distance of about one-third the weld face diameter in either direction from the weld face, allowing a slightly longer play of flame on the high speed side. The pressure will now rise rapidly, due to thermal expansion of the heated sections. Then as the metal in this weld zone becomes heated into the plastic range the pressure gradually falls off. This will be at a temperature of 2300 to 2500 F.
6. When the welding pressure has dropped to a predetermined value of between 3,000 and 4,000 pounds per square inch, maintain this pressure, either manually or automatically. Upsetting will now take place.
7. When a predetermined optimum weld upset has been reached, release the pressure, and remove the piece.
8. Immediately transfer the piece to the annealing furnace at about 1650 F.
9. Cool the piece to room temperature at the rate of 100 F an hour or slower. If this cooling cycle is followed, a hardness of 325 B. H. N. or less will result.
10. Remove the excess weld metal.
11. Machine the cutting edges.
12. Treat the tool according to standard high speed practice for the grade.

Tool Tipping Data

HOW W-T'S* SPEED UP PIPING INSTALLATIONS

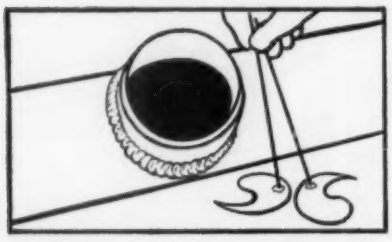


1. Branch pipe outlets can be made with W-T's* anywhere on the main pipe without the use of templets.



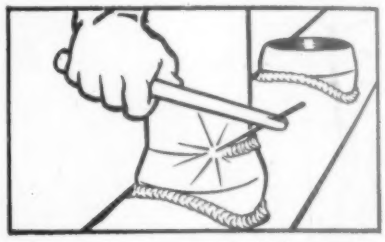
2. W-T's* eliminate all threading and fitting of main pipe in making branch pipe outlets.

3. If outlet is 2" or smaller, hole is cut in the main pipe with drill or hole-saw before W-T's* are installed—on larger sizes, with torch after installation.



4. The use of W-T's* permits inspection of inside of joint, removal of scale and excess weld metal before branch is attached.

5. Funnel-shaped intake of W-T's* reduces vibrational stress at junction—eliminates need of extra braces and hangers.



6. Branch pipe is attached to outlet of fitting by welding—or, if outlet is threaded by screwing into outlet of fitting. W-T's* provide leakproof junction of full pipe strength.

W-T's* are suitable for all commonly used pressures and temperatures in every type of piping system. They can be installed before or after erection of the main line with ease and economy. Equally well adapted to pre-fabricated or "on-the-job" assemblies. Cost no more—in many cases less than ordinary fittings without their advantages. Stock fittings of drop forged steel, but to meet special conditions can be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Write for Bulletin WT-31 giving complete description of all advantages.

*WeldOlets-ThredOlets

3 Types Meet Every Need

Beveled outlet of WELDOLETS permits branch pipe to be attached with plain butt weld.

Threaded outlet of THREDOLETS permits branch pipe to be screwed into outlet or fitting.

Outlet of SOCKET-END WELDOLET is bored to accept standard outside pipe diameters. Junction is completed with weld around top of fitting.

All 3 types available for all standard pipe sizes up to 24".

BONNEY FORGE & TOOL WORKS, - *Forged Fittings Division* - **ALLENTOWN, PA.**

ARMY E NAVY

WELDOLETS · THREDOLETS

TRADE MARKS - REG. U. S. PAT. OFF.

Welded Outlets for Every Piping System

A. D. C. Welding in Britain

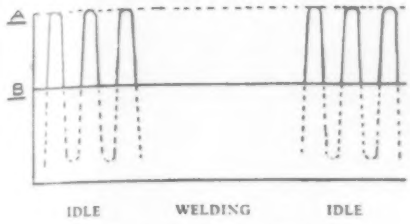


Fig. 1—Action of the A. D. C. welding system. "A"—arc striking A-C voltage; "B"—D-C generator voltage.

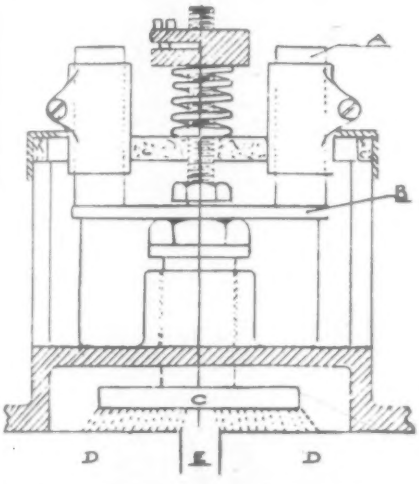


Fig. 2—Plunger-type contactor for breaking the A-C circuit. "A"—round carbons; "B"—circular discs; "C"—armature; "D"—reactance limb; "E"—air gap.

Our allies over the water have developed an arc welder which superimposes an A-C arc-starting current over a normal D-C welding current. The new "A. D. C." system is said to combine exceptional smoothness and economy.

By ERIC N. SIMONS

Member of the British Trade Delegation to U. S. S. R. in 1929; Author of *Structure of Steel*, *Steel Manufacture* and other books.

It is well known that arc welding requires a minimum pressure of about 65 volts to strike the arc, while during the actual operation of welding the voltage across the arc may be only from 20-30 volts. Two methods of meeting this dual voltage requirement have been originated in Great Britain.

The first method is the constant voltage system. The welding current is taken from a generator giving a constant voltage of not less than 60 volts (in practice, more usually 110 volts), and the reduction to the welding voltage is obtained by employing a resistance to absorb the difference between the generator and the welding voltages. Besides being obviously uneconomical, this method has the further disadvantage that the welding voltage may rise too high for good welding should the current be reduced.

The second method is the drooping characteristic generator. Built to give the arc striking voltage at no load, this type of machine is provided with a reverse series field winding so that the voltage falls or "droops" as load is added. Since the amount of "droop" depends on the relative strength of a separately excited field and of the main and reverse excitations, current adjustment requires the accurate setting of at least two field regulators, possibly also of a series diverter. Consequently, there is a great temptation for the weldor to use an incorrect current rather than pay perhaps several visits to the set in order to secure the correct setting.

Another type of D-C machine uses armature reaction to produce the drooping characteristic, but it is still necessary to visit the set to make current adjustments—in this case by moving the brushes.

Owing to the nature of their design, the no-load losses of the drooping characteristic generators are high, and this is important because a single-operator set will run for a considerable proportion of its time at no load. The current range of the drooping characteristic generator is limited, and it can obviously be used only as a single-operator set.

The A. D. C. System

A new system known as the A.D.C. system has been introduced in Great Britain. This *adds* the additional voltage required to strike the arc to the generator voltage by a simple arrangement that does not increase the power needed to drive the set.

By this method, the complications of the drooping characteristic type are entirely avoided, an exciter is not required, there is no limit to the current range, and the same machine can supply more than one operator with an entire absence of interference. The A.D.C. arc is characterized by exceptional smoothness, making the set peculiarly suitable for use by unskilled or semiskilled labor. No time is lost in having to visit the set to make current adjustments, which are under the control of the operator close to his work.

Superimposes A-C Voltage

The A.D.C. generator is compound wound to give a constant low voltage. From two slip rings connected to the armature winding, a low voltage alternating current is taken to a primary coil wound over the usual welding reactance winding. This superimposes an A-C voltage on the D-C generator voltage as shown in Fig. 1, thus providing the requisite arc-striking voltage. Immediately the arc has been struck, the A-C circuit is automatically broken, and the weldor is left with the required D-C voltage.

The contactor (Fig. 2) that breaks the A-C circuit is as simple as the rest of the machine. In every welding reactance an air gap is provided in the magnetic circuit in order to

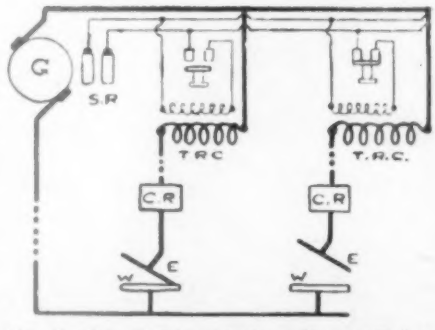
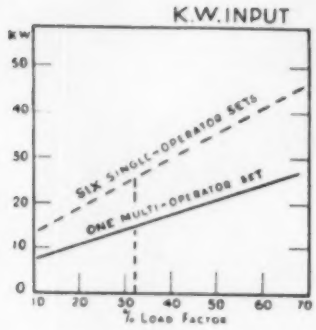
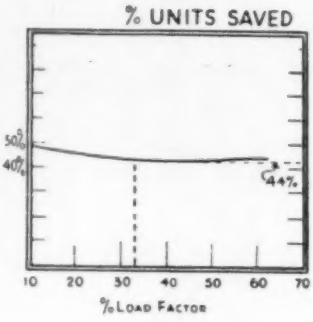


Fig. 3—Two of the contactor units supplied to each operator. That on the left is in the welding position; the other is in the idle position.





Figs. 4 (left) and 5—Charts showing power savings resulting from the use of a multiple-operator set. At 33-1/3% load factor (20 min welding per hr), the six individual sets required 26.2 kw, the multiple-operator set 14.7 kw, resulting in a saving per hr of 11.5 kw or 44%.

avoid saturation of the iron. The magnetic leakage occurring across this air gap is utilized to attract an iron armature, thus breaking the A-C circuit. When the operator stops welding, and there is consequently no magnetism to attract the armature, the A-C circuit is made again by means of a compression spring, and the striking voltage is once more available.

Current regulation is carried out by means of a portable regulator with a multicontact switch giving the desired range of welding current. This regulator is conveniently placed close to the operator, who may be at a considerable distance from the set. Any number of operators can be supplied from the same generator, each operator being provided with a combined transformer-reactance-contactor unit. Fig. 3 gives the connections for two operators, one idle, the other welding.

Advantages of A. D. C.

Several special features make this type of arc welder valuable. First of these is its simplicity. The arc striking voltage difficulty has been overcome by the simple but ingenious expedient of superimposing on the D-C arc welding voltage an A-C voltage of the necessary value. Thus the predetermined voltage of the welding current is maintained without further attention from or adjustment by the operator or operators.

Secondly, there is exceptional smoothness of the arc, and a complete absence of "fluttering." This is important, not only because of the speed and efficiency it gives to welding, but also because it makes welding so much easier that high skill in the operator is not essential.

Thirdly, the welding speed is swifter. The smoothness of the arc provided by the set enables a higher current to be used, and this means that welding can be carried out at a greater speed without any loss in weld efficiency. As wages and overheads form the largest item in welding costs, high speed is all important.

As a fourth advantage, the set can be used with any coated electrode or with bare wire. The arc is perfectly stable from the moment of striking, and there is no "lag." This feature enables thin sheets to be satisfactorily welded.

Ease of Regulation

There is also the large current range. The set can be arranged for a current varying from 10 amp up to 600 amp or more per operator. Ease of regulation is a further advantage. The adjustment of current to suit different diameters of electrodes or different classes of work is made by remote control, thus avoiding loss of the operator's time in going to the set to adjust field regulators or alter brush positions, possibly paying several visits to the set before the correct setting is obtained. With the new machine, the settings are fixed, and similar welding conditions are instantly obtained from the same setting.

Economy in running costs is likewise important. Owing to the time taken in changing electrodes, chipping and adjusting work, the load factor of a welding machine is usually only from 30-50%, and hence the no-load losses form a considerable item of running cost. The no-load losses are specially great with the drooping characteristic type of welding generator in which the no-load voltage is as high as 65 volts with a correspondingly high magnetic flux involving high field and iron losses.

Figs. 4 and 5 show a comparison of results from one multi-operator A.D.C. type set with results from six individual A.D.C. type sets operating under identical conditions at any load factor from ten minutes to 35 minutes welding per hour. All sets were running continuously during the hour on 3 phase, 50 cycle supply.

Long Distance Welding

Welding at long distances from the set is another feature. At the Arno's Vale extension of the London Underground Railway, a two-operator, engine-driven A.D.C. set supplied two operators using $\frac{7}{32}$ in. diam electrodes. Each operator was three quarters of a mile from the set in opposite directions; *i.e.* there was a distance of a mile and a half between the two operators. This example is also the best possible proof that there is no interference between the operators when the multi-operator set is used.

If it is found that the load factor is less than anticipated, circuits for additional operators can easily be added. Moreover, electric drills or electric grinders can be run from the set without interfering with welding carried on at the same time.

As another advantage, extra heavy current can be used if required for such purposes as cutting or carbon arc welding. This is obtained by connecting two or more circuits so as to supply one operator with increased current; *e. g.*, a two-operator set normally supplying two weldors with from 30 to 200 amp each can be used to supply one operator with 60 to 400 amp. No switching or additional cables or connections are necessary.

Fig. 6 shows a Diesel-engine-driven, two-operator A. D. C. transportable welding unit using two hundred amperes per operator, and Fig. 7 shows a multi-operator A. D. C. arc welding set of the tandem type.

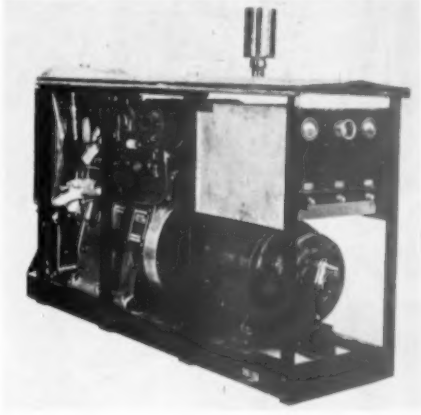
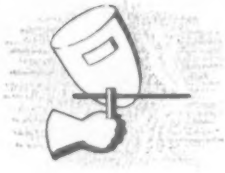


Fig. 6—Portable Diesel-engine-driven A.D.C. welder for two operators, 200 amp per operator.

Fig. 7 (below)—Tandem-type A.D.C. arc welder for three operators, 30 to 200 amp per operator.

PAGE *Welding* ELECTRODES



Of course PAGE developed a new electrode for welding armor . . . Important as that may have been to tank production, it is just as vital—to those who weld Stainless Steel—that PAGE also developed a *complete* range of electrodes for this purpose. In fact, no matter what Stainless Steel you are welding, PAGE can supply you with electrodes that deposit, in the weld, metal that equals the Stainless you are using. That is something worth checking into with PAGE.

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Monessen, Pa., Atlanta, Chicago, Denver, Los Angeles, New York, Pittsburgh, San Francisco, Portland

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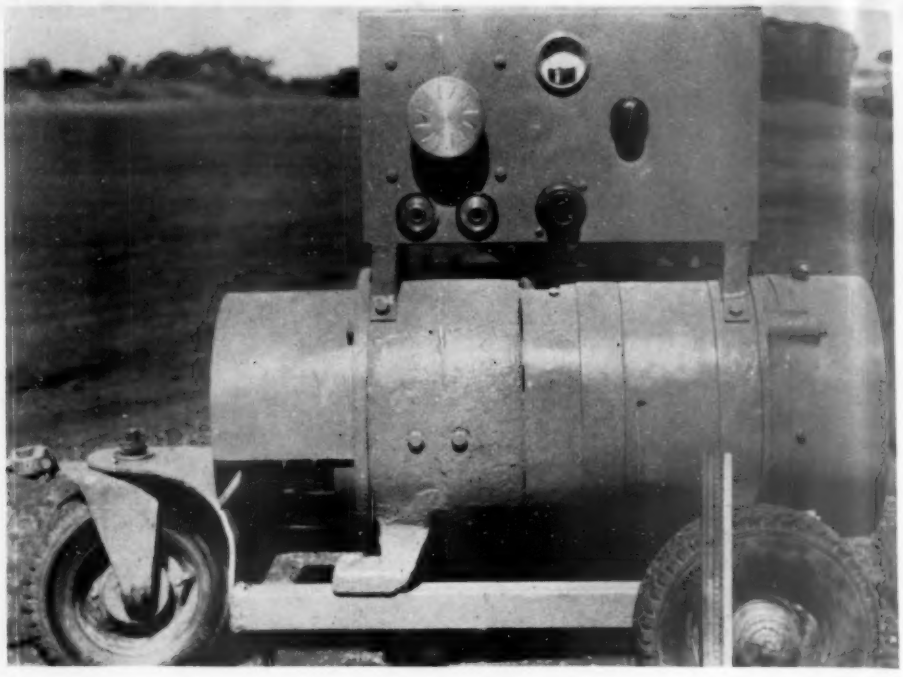
ESSENTIAL PRODUCTS . . . TRU-LAY Aircraft, Automotive, and Industrial Controls, TRU-LOC Aircraft Terminals, AMERICAN CABLE Wire Rope, TRU-STOP Brakes, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Castings, CAMPBELL Cutting Machines, FORD Hoists, Trolleys, HAZARD Wire Rope, Yacht Rigging, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*



This home-made welder supplements a battery of regular arc welding machinery used by the Hume-Sinclair Coal Co., Hume, Mo.

Courtesy, The Lincoln Electric Co.

★ OPERATIONS

Battery Charger to Welder

An ingenious electrician details the steps by which an old battery charger was converted into an arc welding machine.

By **CHARLES CURTOIS**
Chief Electrician, Hume-Sinclair Coal Co.

PRIORITIES and welding equipment shortages need cause no worries if there happens to be a discarded battery charger around. We constructed a first class portable welding machine, complete with control panel and built-in fan, from an old Milburn battery charger dating back to the electric auto era.

Generator Reconstructed

The badly corroded commutator was replaced with a new commutator of larger diameter and having more segments. The armature was reconstructed by rewinding, using single turn coils composed of four double cotton covered No. 12 square wires in parallel. The coils were wound on ½ in. knuckles, dipped in clear varnish, baked, taped, and dipped and baked again. While hot, they were bent on a jig specially made to form all coils alike to the slot angle, making a perfect fit on a bipolar armature. The armature was banded while hot to make a compact job.

The old tape was stripped from the field coils, which were found to be in good condition. The series winding, however, was removed and replaced with four turns of four No. 6 double cotton covered wires in parallel, then dipped, baked, taped, and dipped and baked again. The interpole was treated likewise. After assembly, the shunt coils were connected in parallel, to give a low pick-up voltage, and controlled with a 6 ohm, 50 watt rheostat. The series and interpole winding were connected in series cumulative. The generator voltage ranges from 30 to 55, with an amperage of 190 at 33 volts. The generator is self-exciting.

The original motor winding was of the old type which depended on the battery to bring it up to speed before the motor was thrown on the line. The stator frame had plenty of material in it, if properly used, to deliver almost four times its original 2 hp if changed to 3-phase, 3,600 rpm. The rotor had to be brazed instead of soldered in order to get the necessary power out of it with a minimum of cooling effort.

Cooling Fan

The fan was hand made. It was fastened to the fan arbor, which forms a shaft extension from the motor end ball bearing, but the bearing housing cover had to be bored to clear the arbor, which is held to the shaft with cap screws. A cover was made to fit over the end housing, to force the air through the motor windings and so further help cooling. The customary perforated band was removed and replaced by a solid band.

The amperage selector control was also hand made. It consists of a brass ring main contact with 12 contact segments extending over the ring and a wiping blade to make contact between the segments and ring. The segments are connected to taps brazed onto 200 amp edge-wound resistors.

Control Panel

Like the fan housing and the commutator end cover, the control box was also hand made. It took only a left-over piece of 18 gauge sheet from the material bins. The line switch is a standard D40 magnetic panel, fitted into the control box.

The wheels and tires were salvaged from an old auto trailer. The base angles, front wheel suspension and pull handle were of odds and ends around the shop. The wire was some that had been left over from several large motor rewinds made in the shop. The voltmeter and rheostat were purchased at a radio shop. The current control knob and the plug and socket connections for the cables were turned on a 10 in. lathe.

MECO Equipment Is Producing VITAL WAR MACHINES

☆ On the Production Front . . . on the Battle Front—Meco oxy-acetylene welding and cutting equipment is speeding the day of Victory. ☆ The reliable operation of Meco Safe-T-Chek Regulators reduce production hazards—saves manhours . . . saves time . . . reduces costs. ☆ If you have been disappointed on deliveries of Meco Equipment, bear in mind that every shipment we make is based on the Victory Cause. Meco Equipment is vital to war production. Oxy-Acetylene Cutting and Welding outfits are standard equipment of all of our armed forces, including the ships at sea.

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WELDING AND CUTTING EQUIPMENT

MODERN ENGINEERING CO.

3413 PINE BOULEVARD ST. LOUIS, MISSOURI

New Products to Use

Welder Calibration Plate

★ A new D-C welder calibration plate, called the "Visi-Matic," takes into account three electrode groupings according to low, medium and high voltage

"Visi-Matic" welder calibration plate. It permits quick compensaton for voltage variations due to differences in electrode coatings.

requirements and is claimed to give exactly the right heat across the arc for each electrode. Calibrated in amperes, the new plate is said to provide for all variables of amperage and voltage and to reduce the proper selection of welding current to its simplest form.

Compensation for variations in voltage, as required by variations in electrode coatings, is attained by turning the single current indicator to the desired amperage setting in either the low, medium or high voltage band. Individual color bands are used to designate the voltage ranges. Thus an orange band designates E-6020 electrodes (high voltage), a green band E-6010 (medium voltage) and a yellow band E-6012 (low voltage) electrodes. **Harnischfeger Corp.**, 4513 W. National Ave., Milwaukee.

» «

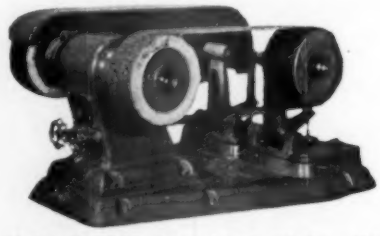
Ransome welding positioner for loads up to 500 lb. Both hand-operated and motor-driven models are available.

Small Welding Positioner

★ A new small-size welding positioner has been introduced by the **Ransome Machinery Co.**, Dunellen, N. J., for handling loads up to 500 lb, with the center of gravity of the load 6 in. away from the table top and with a 6 in. eccentricity. It is available in both hand and motor-operated models and is stated to be particularly suited to work of the type ordinarily handled by women weldors.

The motorized unit includes a Reeves variable speed drive providing a speed range of up to 1 rpm of the table top. In lieu of motorized tilting, the unit can be supplied with a hand wheel for tilting if desired. Tilting range is a full 135 deg from horizontal—45 deg beyond vertical. The 26 in. diam circular table top is T-slotted to simplify clamping. The positioner can be furnished with a regular base for bench work or with a sub-base giving a height adjustment from 27 in. to 42 in. from the floor line to the table top. A clutch arrangement permits free rotation of the table top by hand when required.

» «



Model No. 135 Jones bench grinder. The cushioned segment-faced contact wheel is said to give a fast rate of cutting or grinding and add life to the abrasive belt.

Bench Grinder

★ **Jones Engineering Co.**, Ellwood City, Pa., has added bench grinder and polishing machine **No. 135** to its line of abrasive belt grinding equipment. This is a fast-cutting unit, designed for production output with any ¼ to 2 hp motor and said to be adaptable to any type of grinding and finishing on either flat or irregularly shaped pieces.

Instead of small grinding wheels and hand-coated abrasive polishing wheels, the new bench grinder uses an endless abrasive belt running on a segment-faced, cushioned contact wheel. The controls for belt alignment are located at the front of the machine, handy to the operator. An adjustable spring tension device on the idler pulley maintains belt tension. The standard belt is 2½ in. wide by 48 in. long. Either a 6 by 2½ in. or an 8 by 2½ in. segment-faced contact wheel is available, and rubber contact rolls in diameters ranging from 4 to 10 in. may be obtained for special jobs.

Electronic Heaters

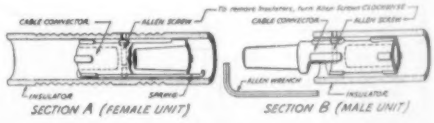
★ A line of electronic heaters for high frequency induction heating of metal parts for brazing, soldering, etc., has been announced by the Industrial Heating Div. of the **General Electric Co.**, Schenectady. These are essentially power oscillators which convert 60 cycle power to high frequency power of approximately 500,000 cycles. Simple circuits are employed, and the necessary electronic tubes, controls and other equipment are arranged in a compact enclosed cabinet. The heaters are available in two standard sizes: 5 kw (illustrated) and 15 kw outputs.

G-E 5 kw electronic heater for high frequency induction heating of metal parts. The design was based on experience with more than 100 installations in General Electric's own plants.

» «

Cable Connector

★ A new cable connector that locks tight, quickly unlocks and is fully insulated has been developed for arc welding by **Jackson Products**, 3265 Wight St., Detroit. This connector, the **"Quik-Trik,"** has interlocking male and female



Jackson cable connector. The connection is quickly made by inserting the male section into female section and twisting to lock the two sections into position.

sections and removable insulators which are held in position with Allen screws. The female section is soldered to the cable lead, and the male section is soldered to the extension. The connection is made by inserting the male section and giving it a twist; the locking spring then rides the cam into position, holding both sections tight. To unlock, the sections are simply twisted apart.

The female section may also be used as a holder handle and connected directly to the "Stinger" end of a Jackson Model TA electrode holder.

Belden welding cables are used in many steps of production at Higgins Industries.

They build them *Fast* at Higgins

—and they don't spare the welding cables

American ingenuity speeds steel tank lighter production at Higgins Industries. And welding has played a most important part in building these ships to help win our war of supply.

Belden welding cables are used extensively in these operations at Higgins and have contributed their share in speeding up production. Their great flexibility saves welders' time, reduces fatigue. Their tough, durable insulation stands up in service over hot steel plates—reducing time lost for replacements.

Investigate Belden welding cable today.

Belden Manufacturing Company
4677-A W. Van Buren St., Chicago, Illinois

Awarded the U. S. Treasury Special Citation of Merit for initiating the War Bond-or-Cash Dividend Plan

Finished Higgins steel tank lighter wins approval in actual test.

Photos courtesy Higgins Industries, Inc.

Belden WIRE

Portable Ventilating Set

★ **United Type "P"** is a portable blower and exhauster combination which may be used for pulling away welding fumes from the worker. It can also be used for blowing and exhausting air, dust, light shavings or similar materials from power presses, hammers, high speed grinders, etc. Three units are available, with ⅓, ½ and 1 hp motors and with air handling capacities ranging from 250 to 980 cfm. Though single phase motors are standard, polyphase or explosion-proof motors can be furnished at a slight additional price. **United Blower Co.**, 193 W. Centre St., New York City.

United Type "P" portable blower and exhauster, designed to facilitate the removal of fumes from the welding zone.

» «

Metallizing Bonder

★ To prepare surfaces for metallizing, **Metallizing Co. of America**, 1330 W. Congress St., Chicago, announces its new **Mogul Electric Bonder**. Purpose of this unit is to deposit electrode metal so as to form rough surfaces that will give a firm bond with the sprayed metal. Though developed originally to prepare heat-treated surfaces for metallizing, the equipment will work equally well on all metals, states manufacturer, and the method is practically as fast as rough threading. The electrode holder is air cooled to eliminate the dangers of overheating, prehardening or distortion, and the operator can control the density of metal deposit by controlling the air pressure. The operator has also a wide range of current selections through a simple one-dial control. The design of the nozzle, it is stated, permits ready adjustment of the electrode to any length, and small corners or internal diameters can be readily bonded.

Mogul Electric Bonder. Instead of grit blasting or rough threading, electrodeposited metal may be used to create the rough surfaces that will insure a bond for metal spraying.

» «

A-C Electrode

★ **Harnischfeger Corp.**, 4400 W. National Ave., Milwaukee, has introduced a new all-position electrode designed for use with A-C transformer-type welders. It is stated to be suited for all mild steel applications and is being made in ⅛, 5/32, 3/16, ¼ and 5/16 in. diam and in 14 and 18 in. lengths.

» «

Motor Starter

★ The Allis-Chalmers **Type H motor starter**, a metal-enclosed structure similar to metal-clad switchgear, utilizes high interrupting capacity disconnecting-type fuses in combination with a heavy-duty oil switch. Type H starters have been developed for both induction and synchronous-type motors rated up to 1,000 hp at 2,300 volts and 1,750 hp at 4,600 volts, three-phase, 60 or 50 cycles. **Allis-Chalmers Mfg. Co.**, Milwaukee.

Castolin Eutectic

LOW TEMPERATURE WELDING

SIMPLIFIED DESIGN

FASTER PRODUCTION

MADE POSSIBLE WITH

CASTOLIN EUTECTIC ALLOY No. 16

PROBLEM

Fabrication of this intricate steel aircraft tubular assembly with high temperature fusion welding was impractical because the high heat resulted in distortion and softening of the metal. Additional time required for machining the joints rendered the process too costly.

SOLUTION

Castolin Eutectic Alloy No. 16 eliminated the distortion and stoftening of the metal. How? This Low Temperature alloy binds at 1300° F. • Gives tensile strength of 117,000 lbs. per sq. in. • Three times faster than fusion welding • One third the cost of silver solder — three times the strength • Clean thin fillets eliminate after-matching.

Castolin Eutectic Alloy No. 16 for use on all steels: chrome-moly, chrome nickel, high speed vanadium steel, iron and malleable iron. Also for joining these to other metals.

Only "Eutectic* Alloys" are the true Low Temperature Welding Alloys that are revolutionizing production welding, maintenance welding and salvaging in war plants throughout the nation. There are 42 specialized rods for every metal and every welding job. Developed and manufactured only by Eutectic Welding Alloys Company.

*Reg. U. S. Pat. Off.

New 36 page Welding Data Book K Write Today

EUTECTIC WELDING ALLOYS COMPANY

SOLE MANUFACTURER - CASTOLIN EUTECTIC WELDING ALLOYS

40 WORTH STREET, NEW YORK, N.Y

Don't Let Eye Fatigue Wreck Work Schedules

Provide your Welders with AO Helmets Equipped with

Filterweld Plates

Keep your workers *on the job* by providing them with easy-to-wear AO helmets—equipped with AO Filterweld, a service-proved welding plate, developed by American Optical Company Research Laboratories.

Filterweld* is obtainable without delay in shade Nos. 8, 9, 10, 11, 12 and 13. It is scientifically controlled in production with fixed standards of densities and conforms with U. S. Bureau of Standards Handbook H24.

Get in touch with your nearest AO Branch Office for American Welding Helmets, Hand Shields and Filterweld Plates.

*T. M.—Reg. U. S. Pat. Off.

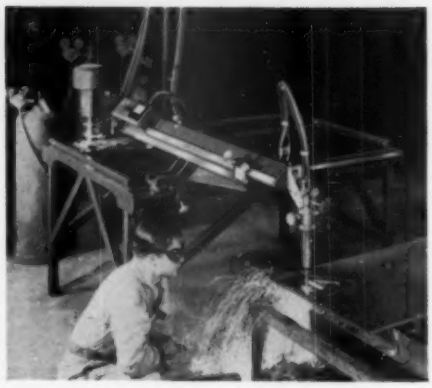
American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

Flame-Cutting Machine

★ Accuracy in cutting, compact size, ease of control and economy of operation are some of the advantages claimed for the new **National Type JR** shape cutting machine, which is designed to handle all types of cutting jobs from the smallest up to an overall size of 3 by 4 ft. If the template tracer is used, the tension and driving rollers grip the template and follow its exact contour so that the shape is automatically cut out by the torch. Fingertip control of the manual tracer allows accurate tracing of the master drawing, and the drive wheel automatically holds to any desired straight line without guidance. A circle cutting attachment is also available, permitting automatic cutting of any circle from 3 to 36 in. in diameter.



Shape cutting with the National JR.

Manufacturer states that this machine will hold the shape to close tolerance, that the top and bottom edges will be clean and sharp and the cut surface smooth, thus minimizing or even eliminating the need for subsequent machining and grinding. The torch may be set to cut bevels at any angle, a calibrated indicator providing for a quick, accurate setting. The driving mechanism is capable of maintaining a uniform travel speed of from 2 to 35 in. per minute. **National Cylinder Gas Co.**, 205 W. Wacker Drive, Chicago.

» «

FOR SMOOTHER WELD GRINDING —3 to 6 TIMES FASTER!

JONES Abrasive Belt SWING GRINDER

You get high-speed weld grinding and smooth, even surfaces with the easy-to-use Jones Abrasive Belt Swing Grinder. This portable unit combines the controlled stock removal feature of a snagging wheel with the smooth surface grinding features of disc grinders.

Speed up your tank grinding 3 to 6 times with the easily portable Jones Swing Grinder, using quick-change, fast-cutting abrasive belts. Readily mounted for covering large areas—simple controls handy to operator—uninterrupted high-speed grinding.

The Ideal Unit for Automatic Weld Grinding—Automatic welding is 2 to 3 times faster than manual operation—why not step up your production line another 2 to 3 times using the Jones Swing Grinder to remove that surplus weld!

CHECK THESE JONES FEATURES

- High Speed Cutting
- Smooth, Even Surface
- Uninterrupted Grinding
- Easy to Install and Operate
- Quick Abrasive Belt Change
- Perfect Balance at Any Angle
- Reduces Time and Cost

WRITE TODAY—
A four-page bulletin "The Jones Abrasive Belt Swing Grinder" gives full details on this time saving, cost-cutting unit. Write for your copy today.

JONES ENGINEERING COMPANY
DEPT. C-1 · ELLWOOD CITY, PA.
Manufacturers of Abrasive Belt Grinding Equipment

Aldex sweat band. It absorbs perspiration as fast as it can form on the worker's forehead.

Sweat Bands

★ To give employees greater comfort during hot weather work, **Aldine Paper Co.**, 373 4th Ave., New York City, has developed the **Aldex** sweat bands for workers to wear about their foreheads. The cellulose fiber filler within the band is said to absorb perspiration immediately on contact and thus keep it from running down into the worker's eyes. The bands fit any size head, are made entirely from non-critical material and are rugged enough to permit rinsing, drying and re-use. Literature and samples are available from the manufacturer.

» «

Voltage Tester

★ The new **Model 590** is a voltage indicator which reads like a thermometer. It is said to indicate: whether the voltage is 110, 220, 440 or 660 volts; whether the current is A-C or D-C; if A-C, whether 25 or 60 cycle frequency; if the appliance, motor, etc., connected in the line is open; which leg is grounded; if the fuse is blown; when one side of an appliance or motor connected to the line under test is grounded; excessive leakage between a motor and a line; when a three-phase motor is running erratically due to a blown fuse. To use this instrument, it is only necessary to connect its needle-pointed test prods across an electric line. No switching is needed. **Superior Instruments Co.**, Dept. T, 227 Fulton St., New York City.

A CHANGE!

from copper to steel easily handled by these SILVER BRAZING ALLOYS

Note the full penetration of EASY-FLO to the inside of each joint—a result of its exceptional fluidity and ability to flow throughout a joint in fast time.

Heat exchangers formerly were brazed in large quantities with the low-temperature silver alloys, SIL-FOS and EASY-FLO. Bronze headers and copper tubes particularly, were joined in fast time. In many plants this was a well organized, reliable, economical operation.

Then, to conserve copper, designs were changed; some to all steel construction, others to iron and steel. But **no change was necessary in the brazing procedure.** SIL-FOS joins only non-ferrous metals, so EASY-FLO simply took over the entire job—and is producing the same strong, leak-tight, permanently sound joints, with the same speed, reliability and economy, as before.

That's one of the big advantages of using this metal joining method —it is versatile—practically any metal which can be heated to the flowing temperature of SIL-FOS (1300°F) and EASY-FLO (1175°F) can be reliably joined.

GET FULL DETAILS IN BULLETIN No. 12-A

This revised bulletin gives you the facts back of SIL-FOS and EASY-FLO speed, reliability and economy. Also tells you how to put them to work in your plant, and gives valuable practical pointers on joint designs, fast heating methods and production boosting procedure.

WRITE FOR YOUR COPY — TODAY

ARMY E NAVY
1ST AWARD August 1942
2ND AWARD February 1943

HANDY & HARMAN
82 Fulton St., New York 7, N. Y.
Agents in Principal Cities. • In Canada: HANDY & HARMAN of Canada Ltd., Toronto

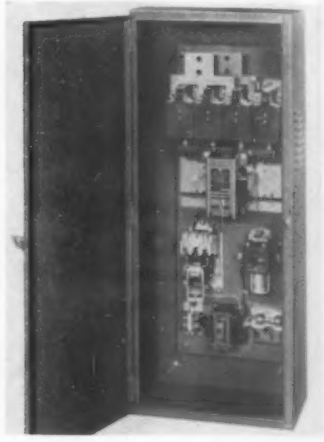
Pipe and Stud Extractors

★ A heavy-duty set of extractors which may be used either for removing broken ends of pipe, tube or nipples or for removing broken stubs of bolts, screws and studs is announced by the **Reps Tool Co., Inc.,** 99 Wall St., New York City. Each extractor is made of forged tool steel and has a heavy square shank that is followed by a sharply tapered, short reverse thread and ends in a square reaming end. The tapered end is inserted in the stub of pipe or in the drilled screw or bolt, giving a powerful four-point grip. The square reamer automatically removes burrs and thus eliminates interference with the extractor's bite. Continued pressure of a wrench on the squared shank will pull the broken piece back outward on its threads.

Reps extractor and piece of broken pipe after its removal from a boiler connection.

The set of ten extractors is supplied in an oak case with selector plate. The set covers the entire range of pipe from ⅛ to 2 in. and studs, bolts or screws from ⅜ to 3½ in.

» «



Square D safety panel. These new panels can be used with any make of A-C transformer-type arc welder.

A-C Safety Control

★ Just announced by the Industrial Controller Div. of the **Square D Co.,** Milwaukee, is a newly developed safety panel to eliminate the hazard created by high open circuit voltages of transformer-type A-C arc welders. These new **class 8992 panels** automatically disconnect the welder transformer after the arc is broken and thus do away with the chance of injury to the operator because of the accidental establishment of a contact between the electrode and a grounded metal surface when not welding. The transformer is automatically reconnected the instant the operator touches the electrode to the work so that the arc can be struck without delay and there will be no loss in operating speed or efficiency.

With the new safety panels, the welding transformer primary circuit is connected to the power line only while the arc is held. External connections are simple, and the welder's internal connections need not be disturbed. Other advantages claimed are a substantial saving in power when a number of welders are used on a single power system and an improved power factor.

» «

Paint Cleansing Compound

★ **Den-tex** is a compound for removing lacquers, enamels, varnishes and paints from the hands without the use of explosive solvents. The liquid is worked into the paint or lacquer on the hands, which are then cleansed by a simple rinse in water, states manufacturer. **Dennis Chemical Co.,** 2701 Papin St., St. Louis, Mo.

C-F POSITIONERS *are universal tools . . . needed wherever welding is done*

Standard in "heavy industry" for turning, tilting and holding giant weldments and assemblies weighing up to 30,000 lbs., so that all sides may be welded "down hand." C-F Positioners are also time-saving, cost-cutting and labor-saving tools on small work—on the "run-of-the-hook" welding of job shops and maintenance departments. 6 sizes including a 1,200 lb. capacity hand operated positioner, each a *universal* tool that is adjustable for height, with a table that turns completely around and tilts to 135° off horizontal.

(Left) Illustrates the "C-F" Adjustable Height Feature that makes "C-F" Positioners universal tools.

Write for Bulletin WP 22

CULLEN-FRIESTEDT CO.,
1309 S. KILBOURN AVE. CHICAGO, ILLINOIS

Victory's ···— Magic Wand?

When the war is won, and victory is reckoned in terms of its contributors, save a pat of praise for a slender shank of steel—the rock drill.

The rock drill bites off the tungsten-tin ores of Bolivia's Chojlla region, chews out Brazilian zirconia, Cuban manganese, and wrests from our own and many another picturesque land, dozens more of the earth's elements essential to victory.

A considerable tonnage of these rarer, critical ores and minerals finds its way to Foote Mineral Company for grinding, beneficiation, or processing by our chemical division.

Yet our sights are not fixed only on supplying and improving the world's mineral treasures. Every day Foote researchers are finding, or helping others to discover, newer, better ways to put ores, minerals, metals and chemicals to work.

If you are interested to know whether Foote products, processes or research can benefit you, make a point of writing to us today.

WHY WE KEEP RUTILE UNDER CONTROL

Rutile is now well established as an economical source of titanium oxide for welding rod coatings. It is well to remember, however, that the general acceptance of rutile was brought about, and persists today, because of the unrelenting control of impurities in the ore and an increased understanding of the importance of the particle size.

If laboratory vigil were relaxed, or if less care were exercised in grinding and grading, the mere economy of rutile would hardly excuse or justify the resulting poor behavior of welding rods.

For uniformly good performance of welding rod coatings, make a point of insisting on the laboratory-controlled quality of Foote Standard Rutile, recommended for minimum spatter loss, maximum arc stability, and smooth operation in all welding positions.

PHILADELPHIA • ASBESTOS • EXTON, PENNSYLVANIA
Home Office: 1609 SUMMER STREET, PHILADELPHIA, PA.
West Coast Representative: GRIFFIN CHEMICAL CO., San Francisco, California
English Representative: ERNEST B. WESTMAN, LTD., London, England

News of the Industry

Torpedo, Shells Fail to Sink Welded Ships

Two more examples of the phenomenal ability of all-welded ships to withstand the severest punishment the enemy can deal are afforded by the all-welded cargo vessel *Edgar Allan Poe* and the all-welded U. S. cruiser *Boise*.

"The *Edgar Allan Poe* has done magnificent service," Chairman E. S. Land of the United States Maritime Commission, revealed in a telegram to the builders, the workers of Oregon Shipbuilding Corp. "Struck by an enemy torpedo amidship, its crew stood their guns and continued to blaze away at the Jap submarine until it was sunk. The entire engine room of the ship was damaged, steam and fuel pipes ruptured, lower decks lifted and great damage done throughout the midship structures. But the bulkheads held, and no water reached any cargo space. The vessel was later towed to port with its entire cargo intact."

The combat record of the *Boise*, the "one ship fleet," is already an epoch in American naval history. But though the *Boise's* guns helped to sink six enemy warships, the feat of bringing the cruiser back to port was even more miraculous. She had taken an 8 in. shell through her hull below the water line and several 5 in. shells for good measure. The resistance of her hull, however, enabled all of these holes to be successfully plugged with bedding. This was made possible by welded construction, which confined the shell holes to the immediate points of contact. Riveted plates would have torn apart under the strain, causing openings too large for temporary plugging.

» «

Why Copper Is Critical

The brass industry of the United States has more than doubled production of fabricated copper and copper alloys since 1939. Though exact figures are secret, the 1943 copper requirements for ammunition are greater than the red metal tonnage consumed by the entire nation for all uses in the peak year of 1929.

Approximately two million pounds of copper and brass go into every ship of the line, and an aircraft carrier requires even more copper and its alloys. About three thousand pounds of brass and copper are used in the construction of every Flying Fortress.

***EX-BEAUTICIAN** George Crissey shows weldorettes the proper coiffure for war production during lunch hour at the Carrier Corporation air conditioning plant, Syracuse, N. Y. George operated his own beauty shop for 12 years but turned in the gadgets to make milady beautiful for an arc welding outfit when Uncle Sam called for war workers. After six months' training, he was able to pass the tough test for certified weldors on Army Air Force equipment. Only fly in George's ointment today is that the girls won't let him alone—they're constantly seeking his advice for a hair-do that will go with weldors' helmets and goggles.*

"Pioneers of Industry" Award to Edward G. Budd

Edward G. Budd, founder and president of the Edward G. Budd Mfg. Co., Philadelphia, is the first recipient of the "Pioneers of Industry" award of the Murrell Dobbins Vocational School. The award, a large bronze plaque, was bestowed upon Mr. Budd as a "pioneer machinist who has not lost contact with the worker, though the head of several large war plants."

» «

New War Paint for P&H Welders

P&H model WN-300 gas-engine-driven welders are abandoning their present maroon-and-gray finish coat for an all-over standard olive drab color conforming to Navy Specification NU-6547. In increasing the production of these machines for the military services and contractors serving the Armed Forces, Harnischfeger Corp. officials found it impossible to provide for the two-color treatment without serious delays. The new color will apply to all unshipped orders.

One Welded Turbine Takes Seven Tons of Electrodes

Welding is playing an important role in the construction of eight 90,000 hp hydro-electric turbines and five 75,000 kva vertical waterwheel driven generators—these being the largest turbines and generators ever installed in the Dominion of Canada. The big units are for the No. 2 Shipshaw power development of the Aluminum Co. of Canada, on the upper waters of the Saguenay river in Quebec province.

The plate steel casings for the turbines have an overall diam of 49 ft 6 in. and an inlet diam of 16 ft 2½ in. The steel plate varies in thickness from 1⅜ in. at the intake to ¾ in. at the small end of the spiral. These casings are stated to be the first large hydraulic turbine castings to be completely arc welded. Over seven tons of welding electrode were required for each turbine.

The eight turbines and five waterwheel generators are being supplied by the Canadian General Electric Co., Ltd., and its subsidiaries. Four additional turbines are being supplied by S. Morgan-Smith Canada Limited.

» «

New Equipment Speeds Carbide Tool Grinding

A new technique which may revolutionize the grinding of carbide cutting tools has been developed coöperatively by Carboloy Co., Inc., and the Edison General Electric Co. (Hotpoint), Chicago. The new principles have as yet been applied only to single purpose machines, but plans are under way to develop more universal types of machines.

The newly devised equipment eliminates the need for skilled or specially trained operators for carbide tools by transferring the operator's skill to the machine, which automatically provides the desired motions and pressures. The first machine developed was a single purpose machine to grind the top faces of standard carbide tools. With this machine, it is stated, the faces are ground in from 8 to 30 seconds per tool, resulting in an output about six times as great as formerly.

In the new process, the grinding wheel not only rotates but also oscillates (in the plane of the wheel) while the tool is held stationary at the correct angle. The oscillation is said to contribute both to the speed with which tools can be ground and to the quality of finish produced.

The second important principle involved in this grinding equipment is that the tool is held against the wheel under a controlled pressure, applied in the Hotpoint grinding machines through air pressure. The tool is first brought against the wheel under low pressure to remove the jagged edges. The pressure then increases automatically to the preset amount and is held at that value until the tool is finish ground. The machines are provided with a dial control for setting the time cycle.

G-R 49

POWER FACTOR CORRECTED

A BEAR FOR PUNISHMENT!

...Readily adapted from Hand to Automatic Operation

YES, SIR, this husky new G-R 49 is the answer to today's heavy-plate welding problems, especially where hard-pressed plants need machines having the extra capacity to handle continuous loads.

Two open circuit voltages give wider welding application within its 100-675 ampere range. The G-R 49 *remains extremely cool*; even if its forced ventilation should become inoperative no damage will result. Contactor with push button control for power supply is provided. Get the facts first hand from your nearest G-R Distributor.

GLENN-ROBERTS COMPANY

1009 FRUITVALE AVENUE, OAKLAND, CALIFORNIA

2107 ADAMS STREET, INDIANAPOLIS, INDIANA

P. O. Box 1814, Washington, D. C.

(Trade Mark Registered)

Titan's Quality Control

ASSURES ABSOLUTE UNIFORMITY OF TITAN WELDING ALLOYS

Doubly-Deoxidized Welding Alloys:

PENN BRONZE

TITAN BRONZE

TITAN MANGANESE BRONZE

Quality Control in manufacture of TITAN Welding Alloys begins with the selection of the finest available raw materials.

Only the purest raw materials are used: Electrolytic copper 99.96 plus in purity, and electrolytic zinc 99.99 plus. This assures the elimination of elements which if introduced would prove detrimental to quality and uniformity.

Maintenance of unvarying uniformity of mixtures and of casting temperatures, under strict laboratory control, further assures absolute uniformity of TITAN Alloys.

Descriptive literature sent upon request

TITAN METAL MANUFACTURING CO., BELLEFONTE, PA.

TITAN WELDING RODS

Name Walker Co. Distributor for Allis-Chalmers Welders

The Walker Electric Supply Co., Terre Haute, Ind., has been made western Indiana and eastern Illinois distributor for the Allis-Chalmers line of welding equipment. The Walker organization includes Joseph Walker, president, and "Chick" Lisman, Harry Loose and Frank Scofield, salesmen.

» «

Changes Firm Name

The welding supply firm formerly known as The Martin Metal Mfg. Co., 900 East Second, Wichita, Kans., is now the Cantrell Supply Co., Inc. P. T. Cantrell continues as president.

» «

Harnischfeger Holds Welding Conference

P & H field men and distributor representatives recently attended a welder conference and school conducted at Milwaukee by the Harnischfeger Corp. They completed "refresher" courses in all phases of arc welding, with particular emphasis upon some of its newest developments including their company's recently introduced industrial A-C arc welders (page 68, THE WELDING ENGINEER, May, 1943).

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DOCKSON CORPORATION
3834 WABASH AVE. DETROIT, MICHIGAN

ABOUT PEOPLE

R. L. Kohlbry, Machinery & Welder Corp., Chicago, and **H. J. Kircherer,** International Harvester Co., Chicago, were recently elected chairman and vice-chairman, respectively, of the Chicago section of the American Welding Society. **T. B. Jefferson,** editor of THE WELDING ENGINEER, was re-elected secretary and treasurer. Directors elected are: M. W. Hippe, Linde Air Products Co.; Charles W. Steele, National Cylinder Gas Co.; Charles O. Druetzler, Electro-Motive Corp.; Eric R. Seabloom, Crane Co.; J. C. Menzies, C. E. Phillips & Co., and C. J. McGregor, American Steel & Wire Co.

» «

R. L. Hawkins and **P. M. Hall** now serve as chiefs of the arc welding and resistance welding sections, respectively, of the War Production Board. Mr. Hawkins was formerly with the Harnischfeger Corp., Milwaukee, and Mr. Hall with the Taylor-Hall Welding Corp., Worcester, Mass.

» «

Dr. C. Earl Webb, noted designer of bridges and western division engineer of the American Bridge Co., Chicago, has been elected president of the Western Society of Engineers for the 1943-44 term.

» «

George W. Person, formerly abrasive engineer in the St. Louis territory for the Norton Company, Worcester, Mass., has taken a position in Chicago as manager of the abrasive division of Screw Machine Supply Co., one of Norton's distributors.

» «

John W. Haddock has been elected president of the Farrel-Birmingham Co., Ansonia, Conn. He was formerly vice-president in charge of engineering and sales of the Sullivan Machinery Co., Michigan City, Ind.

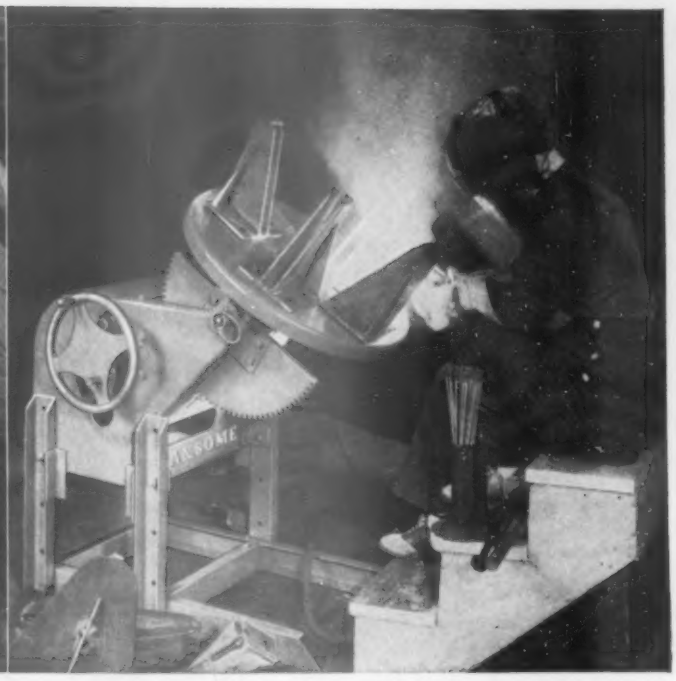
» «

W. S. Edsall has been made manager of the newly combined switchgear and control division of the Allis-Chalmers electrical department, Milwaukee. He was formerly manager of the switchgear division at the Allis-Chalmers Boston works.

» «

Edwin B. McConville, formerly comptroller, was elected treasurer of Skilsaw, Inc., Chicago, at a recent meeting of the board of directors. Mr. McConville was treasurer of the St. Paul firm of Finch, Van Slyck and McConville prior to his association with Skilsaw in 1942.

Installation of a motor-operated unit with variable speed is recommended for circular work.



Hand-operated unit, used by woman welder with set-up of several similar pieces . . . a real time saving.

Now . . . A 500-POUND WELDING POSITIONER BY RANSOME . . . *Motor or Hand-Operated*

The elevating sub-base is a big help in handling large unwieldy pieces.

Showing the importance of the 45° "down-under" position, eliminating resetting of work. The double-end pipe flange shown is typical.

Here's a versatile machine that will help you do better welding faster . . . on a wide variety of work. It's top-quality equipment and ideal for women welders.

- **Table top tilts to 135° from horizontal (45° beyond vertical).**
- **T-slots in table top simplify clamping of work.**
- **Handles a 500 lb. load with a 6-inch center of gravity and a 6-inch eccentricity.**
- **Cut gears are used throughout.**
- **Clutch permits free rotation of table top, by hand.**
- **Available with elevating base, to give 42 inches from floor to table top.**
- **On motorized machine, Reeves variable-speed drive gives range up to 1 r.p.m. for table rotation. Choice of power or hand-wheel tilting.**

Other Ransome Positioners cover a range of types and sizes up to 20 tons. ***Write for literature*** . . . and for recommendations to meet your particular needs.

Ransome WELDING POSITIONERS

INDUSTRIAL DIVISION • RANSOME MACHINERY COMPANY • DUNELLEN, NEW JERSEY

Do You Agree?

Welding Combustible Containers

Q—I am planning to weld a trailer tank truck and am wondering if it would be satisfactory to place 5 lb of dry ice in the tank prior to welding to prevent the likelihood of an explosion.—*C.E.D.*

A—The suggestion of using dry ice is rather hazardous in that you must definitely ascertain the CO_2 content of the tank before welding in order to assure absolute safety. Ordinarily, dry ice does not give sufficient CO_2 to take care of that situation. When dry ice is used for this purpose, it is generally supplemented by an additional source of CO_2 from a cylinder. The carbon dioxide from the cylinder is fed into the tank to insure circulation.

The safest way to do this job would be to fill the tank full of water, after placing the crack to be welded on top. To be absolutely safe, it is recommended that you secure a copy of the American Welding Society publication, "Recommended Procedure to Be Followed in Preparing for Welding and Cutting Certain Types of Containers which Have Held Combustibles."

» «

Electrode Requirements

Q—Can you give me a method for calculating the amount of electrode required to make a fillet weld?—*R.F.H.*

A—To find the weight of steel deposited, calculate the volume of metal required to fill the joint in question, adding to this any metal to be added for reinforcement of the weld joint. The weight of steel may be taken as 0.283 lb per cubic ft. The standard formula for calculating weight is as follows:

$WE = \frac{WS}{1-L}$, where WE is the weight of electrode required, WS is the weight of steel deposited and L is the electrode loss.

The electrode losses are, of course, the weight of the stub ends plus spatter and flux coating. The general practice is to allow 10% to 20% for waste ends, the average being around 17%. For bare or lightly fluxed electrodes, the coating loss is about 13% and on heavy coated electrodes around 25%.

For a normal ½ in. fillet weld placed in a right angle joint, using a heavy coated electrode, the weight of electrode required in lb per linear ft is approximately 0.76.

» «

Brine Welding

Q—What is the brine welding system? —*E.A.D.*

A—Brine system is a term sometimes applied to silver soldering that uses a salt bath as a means of heating the parts to be soldered. In this application, the part to be silver soldered is fluxed, the silver solder applied, and the assembled unit is then submerged in the molten salt bath in order that the heat of the bath will melt the solder. The advantage of the bath (which may be either salt or lead) is that a much better control of temperature is obtained.

» «

Alternating Current Welding

Q—Can a coated welding electrode used for A-C welding be used for D-C work? I am thinking particularly of a type E-6013 electrode.—*R.K.*

A—There is no reason why this A-C electrode should not work satisfactorily with D-C. In A-C welding, the polarity changes very rapidly so that a rod must be suited for use with either polarity. In many instances, however, high quality shielded arc electrodes will provide satisfactory results when used with either A-C or D-C welders.

Object of this department of THE WELDING ENGINEER is to provide the reader with answers to questions of general interest. Selected queries received each month by the editor will be answered on these pages. If you, as a reader, do not agree with our answers, let us know your thoughts. Your comments and discussions will be published, too.

YOU'LL STEP UP
PRODUCTION BY
GRINDING DOWN WELDS
with
SKILSAW
PORTABLE GRINDERS
● Put one of the NEW SKILSAW PORTABLE GRINDERS on your toughest jobs . . . and watch it bite fast into rough welds, smooth down raised welds faster, clean metals, file, buff and polish in less time! When you see its speed, you'll want a SKILSAW PORTABLE GRINDER at once on every war-time surfacing operation.
SKILSAW PORTABLE GRINDERS are fast because they're more powerful . . . yet lighter, more compact for easier handling on more operations. Ask your distributor for a demonstration of SKILSAW PORTABLE GRINDERS now!
SKILSAW, INC., 4763 Winnemac Ave., Chicago
New York • Boston • Buffalo • Philadelphia • Cleveland
Detroit • Indianapolis • St. Louis • Kansas City • Atlanta
New Orleans • Dallas • Los Angeles • Oakland • Portland
Seattle • Toronto, Canada
SKILSAW PORTABLE ELECTRIC TOOLS
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

A GOOD WELD Begins with a GOOD ROD

Tested on a broad scale for the first time, by the strenuous demands of all-out war production, welding has "grown up". It now meets every imaginable need from work on light sheet to the welding of an entire ship. And out of all this emerges the very valuable fact that *only a good rod does a good job!*

Back of Seymour Phosphor Bronze Welding Rods is a long experience in manufacturing Phosphor Bronze for fabrication. They are specially alloyed to produce welds of high tensile strength—and proof that they do this is their large-scale use in the principal war plants of the country.

Contingent upon state of supply, Seymour Phosphor Bronze Welding Rods may be had, under war regulation, through your welding supplies dealer.

SEYMOUR Phosphor Bronze WELDING RODS

The Seymour Mfg. Co., 11 Franklin St., Seymour, Conn.

NON-FERROUS ALLOYS Since 1878

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Pipe Template Book

A new 12-page, letterhead-size booklet, "Pipe Templates for Welded Fittings," tells how to fabricate fittings for welded piping installations by means of welding and flame-cutting and how to use paper templates for flame-cutting pipe. The methods outlined in this booklet, the publisher declares, will save guesswork and spoilage and assure accurate, close fitting connections. The templates and procedures described are intended primarily for use where special fittings are required or where stock welding fittings (which are recommended wherever possible) may not be available. A free copy of this booklet may be obtained by writing to G. Van Alstyne, **Air Reduction Co.**, 60 East 42nd St., New York City.

» «

Manganese Steel Book

Although austenitic or "Hadfield's" manganese steel castings were first produced in the United States fifty years ago, not all American industrial men are as yet fully acquainted with the properties and utility of this product. To help remedy that situation, a 48-page, letterhead-size book has been published by the **American Manganese Steel Div.** of American Brake Shoe Co., Chicago Heights, Ill. This book, which bears the lengthy title, "Manganese Steel—the Toughest Steel Known for General Industry," covers the uses of manganese steel in such industries as mining, quarrying, steel production, railroads, heavy chemicals, glass, sugar, paper, gas and coke, steam power plants, foundries and others. Useful information is included in the reclamation of equipment subject to abrasive wear by hard-facing with manganese steel welding rods.

» «

Weight-Lifting Safety Guide

Strains, sprains and hernias incurred in manual lifting and carrying create a serious productive-time loss which could be largely eliminated by proper handling practices and methods. A 24-page, 7 by 10 in. pamphlet, "A Guide to the Prevention of Weight-Lifting Injuries," has just been published to give information on this subject. The pamphlet, Special Bulletin No. 11 of the **U. S. Div. of Labor Standards**, embodies the recommendations of a group of safety experts, plant physicians and personnel officers who were called together last winter to consider practical methods for preventing injury to workers engaged in the handling of heavy weights. Copies are available at 10 cents each from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C., or from the Div. of Labor Standards, U. S. Department of Labor, Washington, D. C.

» «

Transformer Bulletin

The Transformer Div. of the **Eisler Engineering Co.**, 740-770 So. 13th St., Newark, has published a four-page illustrated bulletin, No. 43-AT, describing this company's air-cooled transformer line. The transformers illustrated can be furnished up to 500 kva in voltages up to 4,800 v.

TYPE C

Securely anchored head has chisel and drift. Carefully tempered to hold its cutting edge longer.

TYPE CB

Same as Type C, but has, in addition, a convenient wire brush for brushing away slag and spatter after being loosened by head of hammer. Easy to use from any position. Weight: 16 oz.

SLAG REMOVAL

Speed Up

WITH CMD WELDERS' CHIPPING HAMMERS

Order from your Welding Supply House!

If they cannot supply you, order direct! Descriptive circular sent free upon request.

For greater output per man hour, equip welders with CMD Chipping Hammers. Well balanced, light and correctly designed for the job, they speed up the clean-up part of the job—the leader since 1925.

CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY

Dept. W., 1928 West 46th St., Chicago, Illinois

TOOL OF THE MONTH

ATLAS

SYMBOL HAMMER

Permanent Welder Identification in the work itself, combined with choice of replaceable chisel or cone, Heavy Duty Slag Removing Bit in a Sixteen Ounce Hammer.

Write for circular describing simplified systems of identification.

The Most Complete Line of Weld Cleaning Tools on the Market

UNIVERSAL TOMAHAWK
"Standard" and "Heavy-Duty" weights

SYMBOL HAMMER
for welder identification

DUAL-TOOL MODEL A

DUAL-TOOL MODEL B

PROVED · PRACTICAL
ATLAS
WELDING ACCESSORIES

TOMAHAWK MODEL NO. 1
"Standard" and "Heavy-Duty" weights

TOMAHAWK MODEL NO. 4
"Standard" and "Heavy-Duty" weights

TOMAHAWK MODEL NO. 2
"Standard" and "Heavy-Duty" weights

CLEANING BRUSH
featuring "Grip-Tight" Brush Holder

TOMAHAWK MODEL NO. 3
"Standard" and "Heavy-Duty" weights

Famous Atlas Enduro Hardening assures extra service

Your Dealer will be glad to recommend the ATLAS Weld Cleaning Tool best adapted to your requirements.

ATLAS WELDING ACCESSORIES CO.

307 BOULEVARD BUILDING · DETROIT, MICHIGAN

EXPORT DISTRIBUTORS: International Technic, Inc., 381 Fourth Avenue, New York City
CANADIAN DISTRIBUTORS: Rudel Machinery Company, Ltd., Montreal, Toronto, Windsor

Positioner Bulletins

Two letterhead-size leaflets have been published by the Industrial Div. of **Ransome Machinery Co.**, Dunellen, N. J., to picture and describe different types of welding positioners. Bulletin No. 188 covers turning rolls for facilitating the welding of large cylindrical tanks and drums. Bulletin No. 196 illustrates and describes a 2,500 lb capacity, hand-operated positioner.

» «

"Safety Speeds Production"

The above is the title of a 24-page, 6 by 9½ in. pamphlet published by the **Div. of Labor Standards,** U. S. Department of Labor, Washington, D. C., in response to requests from management for material on safety training. Directed to supervisors, the information included comes from the experiences of hundreds of foremen. It was reviewed for accuracy and usefulness by safety engineers in large war plants acting as representatives of the Labor Department's National Committee for the Conservation of Manpower in War Industries.

» «

Steel Products Manual

Data on "Hot Rolled Rounds and Round Cornered Squares for Forged Shell" has been published as Section 3 of the Steel Products Manual. The rounds range from 3 to 8 in. in diameter, and the round cornered squares extend up to 12 in. **American Iron and Steel Institute,** 350 Fifth Ave., New York City.

» «

Cleaning Safety Equipment

The care and maintenance of respirators, goggles, face and eye shields, welding helmets, and other safety equipment form the subject of a 5-page "Field Service-Special Report" from the Technical Engineering Laboratory of **Oakite Products, Inc.,** 22 Thames St., New York City. This report concisely describes the approved materials and methods for cleaning and sterilizing welders' safety equipment, including goggles, helmets, shields, hose masks, rubber gloves, etc.

» «

Air Conservation Posters

"Use the air you need, but DON'T WASTE IT" is the theme of a new series of industrial posters available from the **Ingersoll-Rand Co.,** 11 Broadway, New York City. At the present time there are five 11 by 14 in. posters, with others in preparation. The posters are printed in two colors and make generous use of "splash" illustrations. The purpose of the series is to wage war on leaky hose couplings, valves, etc. and so help to speed distribution and avoid wasted air power.

» «

Electrode Index

A new 17 by 11 in. electrode comparison chart should simplify the buying of competitive welding electrodes. The chart details the principal AWS and ASTM electrode classifications and tabulates the trade names of electrodes produced by 20 leading manufacturers meeting their requirements. It can be used to determine all the brands of electrodes which fall within a specified AWS and ASTM category so that alternate brands may be selected in the event that the particular electrode ordinarily used becomes temporarily unavailable. A free copy may be secured by writing to G. Van Alstyne, **Air Reduction Co.,** 60 East 42nd St., New York City.

» «

Fire Fighting Manual

"How to Teach Fire Fighting" is a 16-page, letterhead-size manual issued to aid factory executives in instructing their employees in fire-extinguishing techniques. This booklet explains in simple terms the classification of "A," "B" and "C" fires, tells the kinds of extinguisher best suited to each fire class and describes the methods of setting up demonstrations in order to teach the proper use of each type of extinguisher. This publication is offered without cost to any plant requesting it. **Walter Kidde & Co., Inc.,** 140 Cedar Street, New York City.

WITH MARQUETTE
REGISTERED U.S. PAT. OFFICE
A.C. ARC WELDERS

LOW INITIAL COST
LOW UP-KEEP
LOW OPERATING COST
NO "MAGNETIC BLOW"
ALL ASBESTOS INSULATION
TEN SUPERB MODELS
★ 10 DAY DELIVERY

Instantaneous heat selection is a typical example of how MARQUETTE's fast, simple operation takes full advantage of the inherent speed of welding.

Accurately calibrated outlets provide a tap for every heat and a heat for every job. Thus the operator gets off to a quick start on any job of metal fabrication or repair. No questionable manual adjustment of confusing dials or gadgets is needed to secure proper welding power. Automatic Voltage Control over the entire amperage range assures perfect current for strong, uniform, flawless welds.

Send for free, 24 page, illustrated booklet.

MARQUETTE MFG. CO., INC.
MINNEAPOLIS, MINNESOTA

MARQUETTE
REG U.S. PAT. OFF.
A.C. ARC WELDERS

THIS MOTOR BRACKET

typifies the advantages of modern EASY-FLO Brazed Construction

This hanger bracket for a small electric motor used in airplanes is one of a long and growing list of parts formerly made from castings or forgings that have been redesigned for EASY-FLO brazed construction.

The reasons so many are changing to EASY-FLO brazed construction are—faster production—elimination of machine operations—reduction in weight—metal saving—and last but not least, low costs.

EASY-FLO IS THE KEY to the success of this low-temperature silver alloy brazed construction, because it makes joints that are as strong as solid metal—and makes them fast, reliably and at surprisingly low cost per joint.

You will find interesting details about it in **Bulletin No. 12-A.** Also valuable information on joint designs, heating methods and fast production procedures. A copy will be mailed to you on request—write for it now.

EASY-FLO BRAZING IS HERE TO STAY. *The exceptional speed, reliability and economy EASY-FLO brings to the joining of both ferrous and non-ferrous metals account for the phenomenal spread in its use on war production and assure an increasing use in peacetime maufacturing. Get the facts in Bulletin No. 12-A. Plan to use it in your post-war production.*

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Chicago, Ill., 3348 S. Pulaski Rd., Phone Crawford 4400
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Depend on..

to meet today's needs!

1. A SUPER FLEXIBLE, RUBBER COVERED, DURABLE CABLE FOR ALL FORMS OF ARC WELDING. HUNDREDS OF THOUSANDS OF FEET NOW IN USE IN ORDNANCE PLANTS, SHIPYARDS AND WAR INDUSTRIES.
2. — — — — SIZES AVAILABLE NO. 4 TO NO. 4/0 125 TO 550 AMPS — — — —
3. ATTRACTIVE CONSUMER PRICES—LET US QUOTE ON YOUR NEEDS.
4. WRITE FOR IMPORTANT AND COMPLETE DEALER INFORMATION.

CONTINENTAL WELDING CABLE CO.

PHONE FRANKLIN 7100

333 NORTH MICHIGAN AVENUE CHICAGO, ILLINOIS

Welder Bulletin

A four-page, letterhead size bulletin, B6241B, has been issued by the **Allis-Chalmers Mfg. Co.**, Milwaukee, to announce its new Ampac "200" A-C arc welder (see page 60, June issue of THE WELDING ENGINEER).

» «

Insulating Coating Catalog

An 18-page, letterhead-size catalog devoted to the subject of insulating compounds for electrical equipment has just been published by **The Insl-x Co., Inc.**, 857 Meeker Ave., Brooklyn, N. Y.

» «

Electric Gauge Data

An 8-page, letterhead-size booklet, **GEA-3991**, describes the functions of 21 electric gauges, including thickness, magnetic, electrolimit, pressure, strain and eccentricity gauges. The description is confined to electromagnetic types of gauges, the basic gauge being, fundamentally, an A-C bridge circuit in which one or more impedance branches are acted upon by the quantity to be measured. The calibrated amount of bridge unbalance is indicated on an instrument, which may be remotely installed at any convenient location. A chart showing schematic representations of various electric-gauge circuit applications is included. **General Electric Co.**, Schenectady, N. Y.

Motor Control Manual

How to select and apply motor control is explained in a 16-page, letterhead-size manual, **GEA-4015**, titled "Simplified Guide to the Selection and Application of Commonly Used Motor Controls." Starting with a simple analysis of the functions of control, this booklet describes the basic control parts of industrial devices and discusses the selection of correct control equipment, explaining how to choose between manual and magnetic. **General Electric Co.**, Schenectady, N. Y.

» «

Press Welder Bulletin

Bulletin P-50C has been published by the **Pier Equipment Mfg. Co.**, Benton Harbor, Mich., to describe its recently announced P-50 and P-100 air-operated press-type projection and spot welders. Besides giving construction, equipment, the bulletin also includes a chart of welding capacities.

» «

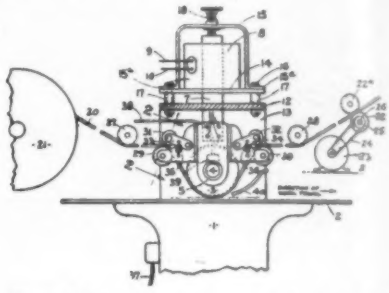
War Contract Booklet

"Spreading the Work," a 24-page, 4 by 8½ in. booklet, has been published by the **Smaller War Plants Corp.**, Washington, D. C., to assist the prime contractor and the subcontractor in problems arising out of their relationships with the procurement services.

FROM THE PATENT OFFICE

Automatic Arc Welder

2,319,401. **Edward S. Hebeler**, Williamsville, N. Y., assigned to **Unit Rays, Inc.**, Cleveland. Filed Jan. 3, 1941. Issued May 18, 1943.



Pertaining to the automatic arc welding of metals by means of a non-melting electrode operating within a gaseous shield, this patent covers the operations of (1) continuously propelling successive portions of a wire through the welding zone at a predetermined speed, (2) maintaining the portions passing through the zone at a predetermined distance from the work, and (3) directing a jet of gas under pressure between the work and successive portions of the wire.

Victory's MAGIC SPARK

☆ Whether it be fixing the drawbar on Jim Beck's tractor, sorely needed on the food front! Or repairin' the axle of Jack Bailey's car that hauls four other workers and himself to Allison's each day! Or performing any of the million and one welding operations in providing armament . . . land, sea and air . . . for Uncle Sam's fighters! *Welding is "Sparking" America to Victory!*

As makers of Miller AC Welders, we're proud to be a part of this vital industry. And we pledge you a continuance of Miller ingenuity and craftsmanship that spells *faster* welds, *stronger* welds for you.

For *your* goal and *our* goal are one and the same . . . V-DAY for America!

MILLER ELECTRIC MANUFACTURING COMPANY
Sales: Richmond, Indiana Factory: Appleton, Wisconsin

★ ★ Miller AC Welders ★ ★

A Pledge from
AMPCO *Employees*

The Men and Women of Ampco Metal, Inc. feel honored in having received the Army-Navy "E". We take this to mean that we have not failed to keep the faith with the men in uniform.

Since nothing has been done that cannot be done better, we pledge that in the months to come, our minds, hearts and muscles will be devoted to the production of still more of the finest materials. Certainly our very best is the very least our fighting men deserve. We will back them every step of the way to final VICTORY!

Duke Ruppenthal
President

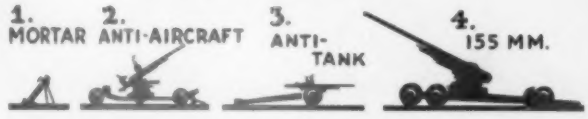
EMPLOYEES MUTUAL BENEFIT ASSOCIATION
OF AMPCO METAL, INC.

AMPCO METAL, INC., MILWAUKEE, WIS.

AMPCO METAL

THE METAL WITHOUT AN EQUAL

It takes ALL FOUR to win VICTORY . . .

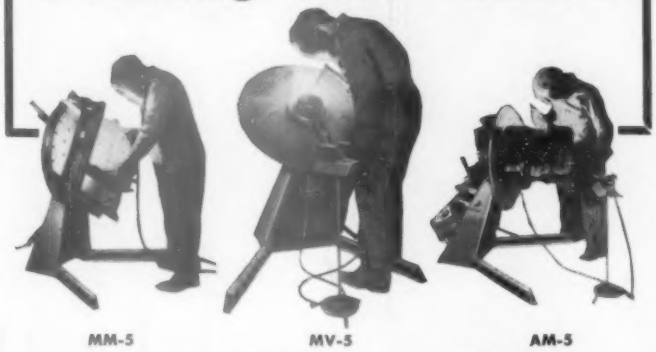


On the FIRING LINE . . .

Sure, they all shoot shells. And they're all equally important. But each one does certain jobs better than the others can do it. That's why Uncle Sam's fighters use ALL FOUR!

And on the PRODUCTION LINE . . .

BENTLEY
Welding Positioners



MM-5
Hand Tilt
Hand Rotation
Indexing rectangular parts at constant angle of tilt

MV-5
Hand Tilt
Variable Speed Rotation
Rotating circular parts at desired welding speed for hand or automatic welding at constant angle of tilt

AM-5
Air-Actuated Hydraulic Tilt
Hand Rotation
Indexing rectangular parts and tilting from horizontal to vertical by shop compressed air

AV-5
Air-Actuated Hydraulic Tilt Variable Speed Rotation with power tilt through 90 degrees—the all-purpose machine

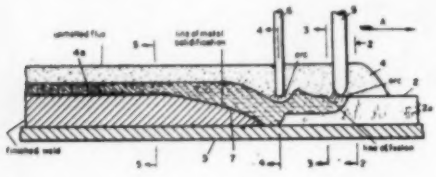
ALL FOUR of these Bentley Welding Positioners hold, tilt and rotate a weldment. One of them is operated by hand. One has hand tilt with variable speed power rotation. One has air-actuated hydraulic tilt and hand rotation. And one has air-actuated hydraulic tilt and variable speed power rotation. Possibly you could do all your positioning with any one type (500 lb. capacity, 6 in. above and off center of faceplate). But you could do a better job by selecting one or more of the various types adapted for certain specific jobs. FOR EACH OF THE FOUR DOES CERTAIN JOBS BETTER. And a combination of ALL FOUR will give your shop that EXTRA PUNCH which spells victory on every contract and in the face of any competition.

Write or wire for full description and prices. Prompt delivery.

BENTLEY WELDERY, Inc.
Syracuse, N. Y.

Submerged Flux Welding

2,320,824. **George G. Landis** and **L. Keever Stringham,** University Heights, O., assigned to **The Lincoln Electric Co.,** Cleveland. Filed June 27, 1941. Issued June 1, 1943.



A method of arc welding metal parts by melting down abutting edges under a deep layer of flux. The parts are first preliminarily joined while a portion of the flux layer is rendered molten. The metal of resultant juncture is then subjected to further fusion without removal of the previously melted flux.

» «

Metal Spray Preparation

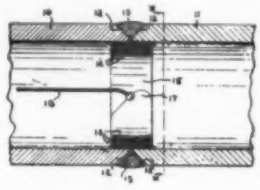
2,320,327. **John Frank Meduna,** Seattle, Wash., assigned to **Metallizing Engineering Co., Inc.,** Long Island City, N. Y. Filed Aug. 6, 1942. Issued May 25, 1943.

An improved method of preparing surfaces for the application of sprayed metal. This method comprises contacting multiple small individual areas of the surface to be coated with at least one metal electrode, thus establishing arcs between these electrodes and the metal surfaces undergoing preparation and thereby depositing small amounts of electrode material. The metal is deposited in such fashion as to form a surface characterized by an irregular roughness, having a multitude of projections with overhanging edges and minute craters with overhanging edges. Thereafter, the sprayed metal is applied onto the metal surface thus conditioned.

» «

Weld Backing Ring

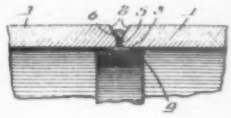
2,321,308. **Ernest F. Miller,** Lansdowne, Pa., assigned to **Westinghouse Electric & Mfg. Co.,** East Pittsburgh, Pa. Filed April 15, 1942. Issued June 8, 1943.



A backing device for internal use when welding abutting ends of tubular members having aligned circular passages. Adapted to be removed after the welding operation, this device comprises a relatively thin strip of material wound upon itself to provide a laminated ring that is removable by unwinding.

Pipe Welding Ring

2,320,700. **Charles E. Kent** and Otto M. **Carlson,** Chicago, assigned to Crane Co., Chicago. Filed Nov. 28, 1940. Issued June 1, 1943.



This patent pertains to a thermally disintegrable back-up ring used in the process of joining tubular members by welding when the members are assembled in end-to-end relation with a space between them for the welded joint. The ring has an outside diameter substantially equal to the inside diameter of the tubes being welded. It consists of a pair of concentric circular members, the outer member being of an organic plastics material having high heat insulating and slow burning properties and the inner member being of an easily combustible material. The ring is inserted in position so that the outer circular member is in substantial contact with the inside walls of each tubular member being welded. Though the inserted ring combination is tardily combustible at preliminary welding temperatures, upon the subsequent combustion of the inner circular member the ring is disintegrated to such an extent that it is readily removable from the joined tubular members.

HERCO VARIABLE CORE ARC WELDERS for:

MODELS FROM 150 TO 1500 AMPERES WITH OR WITHOUT POWER FACTOR CORRECTION

24 hour per day operation.
Exact heat control.
Increased production.
Lower power costs.
X-ray test welding.
Ease of operation.

Inquire about MAGNETIC CLAMPS for quick positioning and alignment.

HERCULES ELECTRIC & MFG. CO. INC.

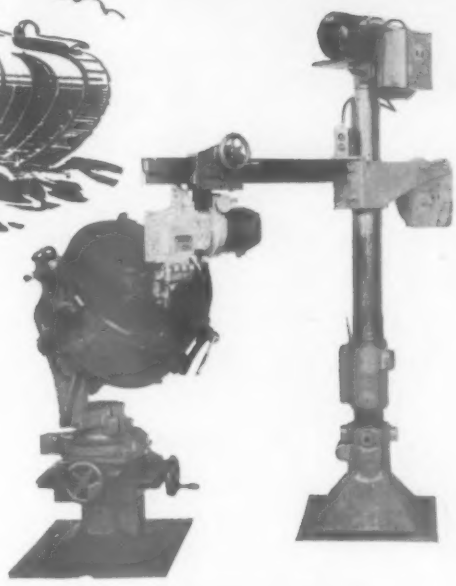
MANUFACTURERS OF THE PRECISION WELDER WITH THE STREAMLINED ARC

2416 ATLANTIC AVENUE • BROOKLYN, N. Y.

Quicker Welding . . With This Automatic Welding Machine Fixture

THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.



Reloading Is done During Welding Operation

ACME *Manufacturing Co.*
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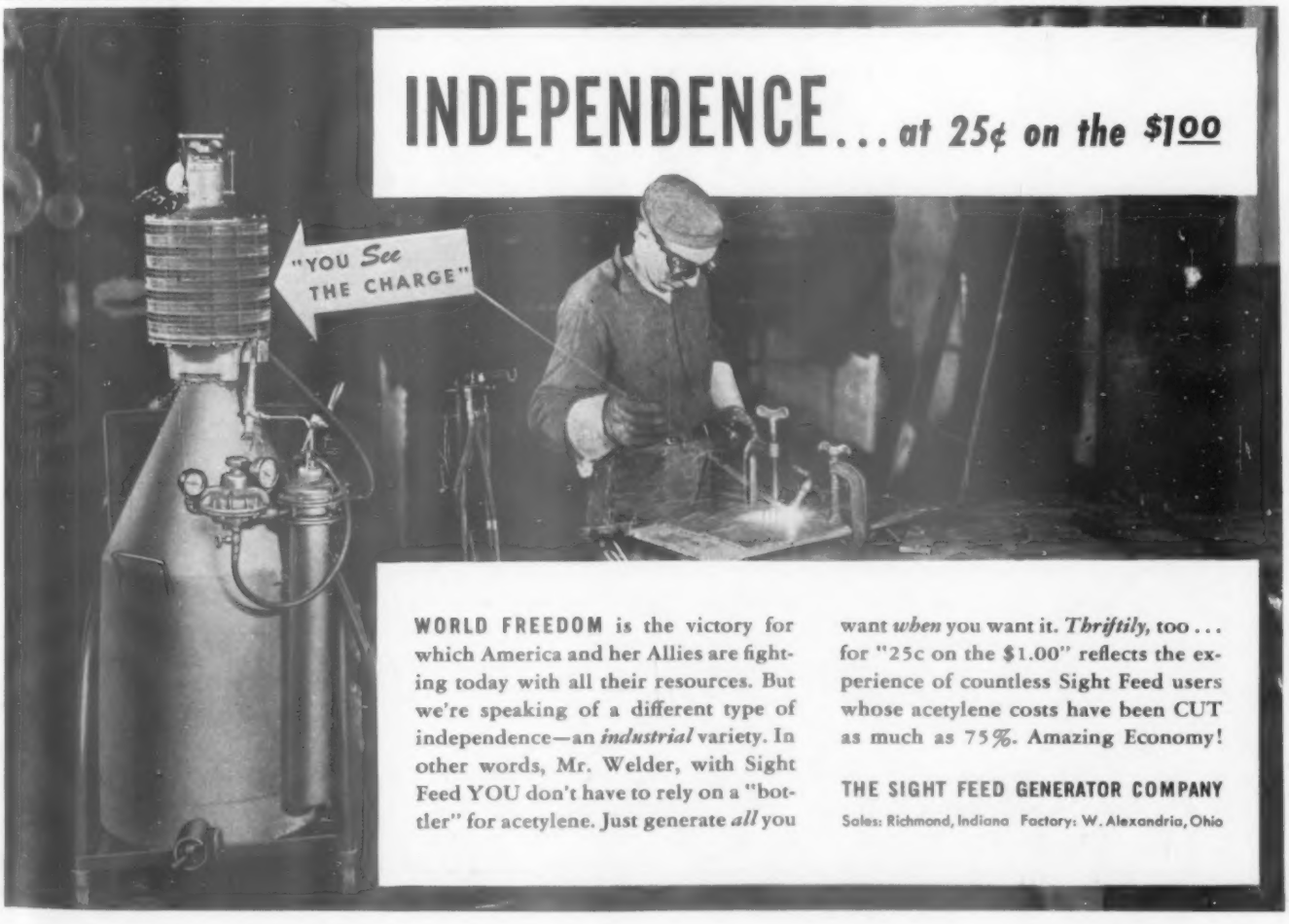
WRITE
for information. Whatever your positioning problem on automatic welding, let us help you solve it. Write for complete information.



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WORLD FREEDOM is the victory for which America and her Allies are fighting today with all their resources. But we're speaking of a different type of independence—an *industrial* variety. In other words, Mr. Welder, with Sight Feed YOU don't have to rely on a "bottler" for acetylene. Just generate *all* you want *when* you want it. *Thriftily,* too . . . for "25c on the $1.00" reflects the experience of countless Sight Feed users whose acetylene costs have been CUT as much as 75%. Amazing Economy!

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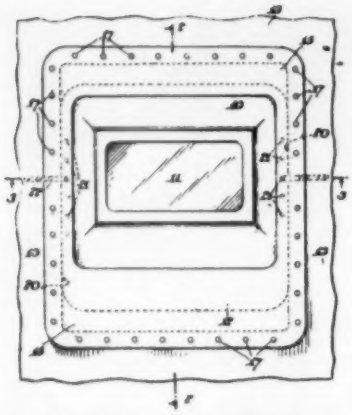
Sales: Richmond, Indiana Factory: W. Alexandria, Ohio



Adjustable Glass Holder

2,320,214. **Frederick M. Bowers,** Chester, Pa. Filed Feb. 19, 1942. Issued May 25, 1943.

This patent pertains to the glass holder of a weldor's helmet. It includes a flange attached to the holder, vertical ways for slidingly mounting the flange and horizontal ways to provide top and bottom clearances for the flange travel. The flange rides in these clearances in all positions of the holder, thereby maintaining the welding lens in front of the sight opening of the helmet at all times.

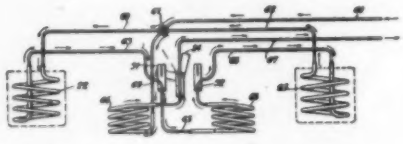
» «

Hard-Facing Alloy

2,321,227. **William C. McLott,** Grand Rapids, Mich. Filed Aug. 6, 1941. Issued June 8, 1943.

A strong, tough and abrasive-resistant alloy for deposition upon a ferrous base. Alloy consists of chromium between 25% and 33%, molybdenum between 1.5% and 5%, copper between 1% and 3%, manganese between 0.5% and 2%, titanium between 0.3% and 1.5%, carbon between 3% and 3.25% and silicon between 0.7% and 1.3%. The balance is of iron, with negligible quantities of the usual impurities.

» «



Induction Heating Apparatus

2,321,189. **Paul E. Dravneek,** New York City, assigned to **Induction Heating Corp.,** New York City. Filed Dec. 26, 1942. Issued June 8, 1943.

Pertaining to induction heating apparatus operated with current from a high frequency power oscillator, this patent covers the combination of two tank circuit output transformer primary coils, electrical connections and switch for alternatively connecting the coils to complete a tank circuit of the oscillator. Conduits for cooling fluid, communicating with the connections and coils, permit cooling streams to be maintained through both coils.

Aluminum Welding Flux

2,321,309. **Mike A. Miller,** New Kensington, Pa., assigned to **Aluminum Co. of America,** Pittsburgh. Filed Dec. 31, 1941. Issued June 8, 1943.

A fluorine-free alkaline metal chloride base flux for welding aluminum. Flux is characterized by its ability to remove the oxide from aluminum surfaces thoroughly and rapidly during welding. It contains from about 0.5% to 5% of an alkali boryl sulphate.

» «

Hard-Facing Method

2,319,977. **Arthur T. Cape** and **Antone Gaxiola,** Santa Cruz, Calif., assigned to **Coast Metals, Inc.,** Canton, O. Filed May 26, 1942. Issued May 25, 1943.

A method of applying a coating of a heat-resistant ferrous alloy containing aluminum. An electrode or welding wire of this alloy minus the aluminum is used to establish an arc. Simultaneously the aluminum is fed to the arc in regulated amounts so as to form more than 2% of the heat-resistant coating.

» «

Spot Welding Electrode

2,320,920. **James Fletcher,** Detroit, assigned to **Tipaloy, Inc.,** Detroit. Filed March 14, 1942. Issued June 1, 1943.

A spot welding electrode consisting of a copper alloy having a thin adherent silver coating that covers the welding face and also extends up the sides.

Type BX
(Patented)

Multiple adjustment. Comfortably snug fit. Opaque side protectors. Lens (Federal specification) held securely in place in durable retainer.

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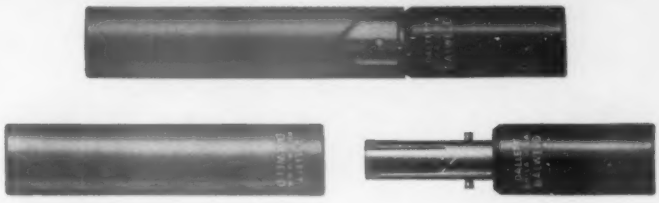

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Hydraulic WELDING POSITIONER

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. . . tilts, lifts, turns heavy, clumsy pieces

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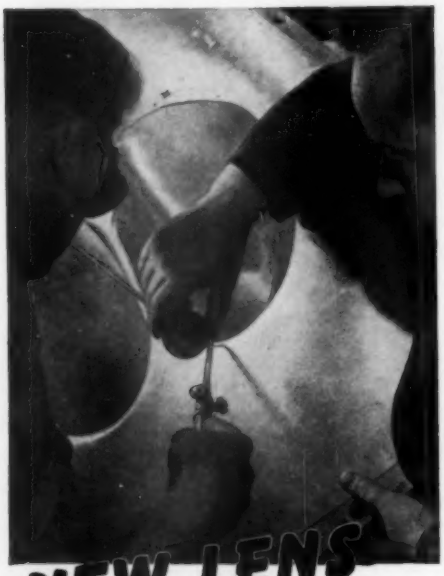

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Glare from hydrogen flame and burning flux eliminated... eye strain, fatigue, mistakes reduced... that's the story in a nutshell of the amazing new McDonald BURT-WELD Lens. Only slightly opaque, it enables welders to see their work for the first time, filters out only the blinding glare. Standard size and shape, it fits any goggle taking a 50 mm. round lens.

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Safety FROM HEAD TO FOOT

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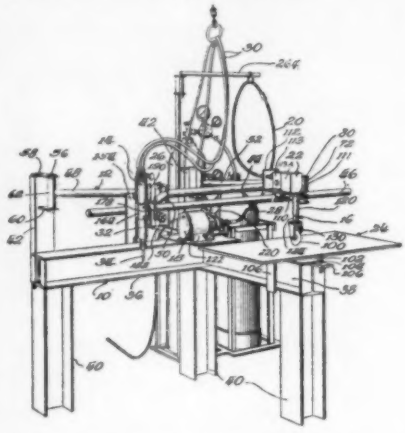
Flame-Cutting Machine

2,317,526. **Stanley W. Hayes,** Richmond, Ind., assigned to **Hayes Track Appliance Co.,** Richmond, Ind. Filed March 20, 1940. Issued April 27, 1943.

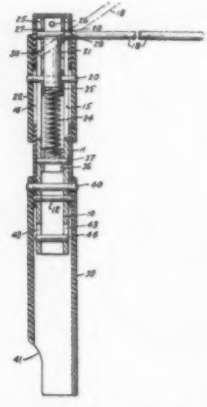


This flame-cutting apparatus includes a stationary L-shaped support and a pantograph assembly pivotally connected to the longer leg of the support so as to be universally movable in a substantially horizontal plane above the support and in front of the longer leg. A rolling support attached to the structure is movable in any direction over an area in the vicinity of the shorter leg of the L-shaped support. The material to be cut is moved over an area spaced in a direction substantially parallel to and in the direction of the longer leg.

» «

Electrode Holder

2,317,780. **Clifford Laskey,** Albany, Calif. Filed June 1, 1942. Issued April 27, 1943.

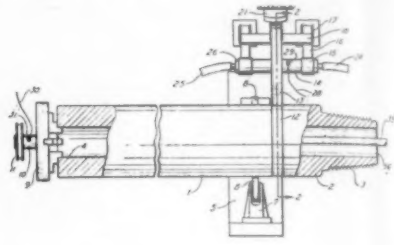


An electrode holder comprising a tubular electrical conductor with a pair of complemental slots extending longitudinally from one of its ends, an insulating cover, and an electrode-receiving opening in the cover in registry with one of the slots in the tubular member. The cover also has a pair of complemental slots spaced apart from one of its ends in registry with a portion of the slots in the tubular member. An electrode-engaging member is slidably received in the tubular member; a spring seated in the latter normally urges the electrode-engaging member past the electrode-receiving opening in the cover. A sleeve of insulating material slidably encases a portion of the cover; this sleeve has a non-conducting coupling with the slidable electrode-engaging member through the slots in the cover and the tubular member.

» «

Hard-Facing Method

2,318,263. **Frederick C. Smith, Jr.,** Houston, Tex., assigned to **Hughes Tool Co.,** Houston. Filed Nov. 8, 1941. Issued May 4, 1943.



A method of hard-facing a steel tool joint member for use in well drilling, the member having a cylindrical outer surface adapted to contact with the wall of the well. A groove is formed circumferentially about member, and an electrically conducting pressure wheel is mounted to fit resiliently into the groove. Granulated hard metal of comparatively high melting point is fed into the groove while member and wheel are rotating, and an electric current is simultaneously passed from the wheel to the member. The current instantaneously heats the steel in the bottom and side walls of the groove at the point of contact of wheel and member, melting the surface of the groove and attaching the hard unmelted particles in position. Upon cooling, a band of wear-resistant metal is firmly embedded in the groove.

» «

Respirator

2,318,790. **George E. Martindale,** Lakewood, and **Otto W. Scharping,** Cleveland, O., assigned to **The Martindale Electric Co.,** Lakewood. Filed Sept. 8, 1941. Issued May 11, 1943.

Means for holding a flexible air filter against the nostrils of a wearer. The support includes spaced parts arranged to be positioned on the two sides of the nose and attached to a tie that is constructed and arranged to be positioned underlying the nose of the wearer when the support is in position. When the support and tie are in position, an upward pull is exerted against the ends of the tie, causing it to flex about the base of the nose and draw the filter against the wearer's nostrils.

» «

Brazing Rod

2,319,539. **Louis C. Dodd,** Buffalo, assigned to **Magnus Metal Corp.,** Chicago. Filed April 2, 1941. Issued May 18, 1943.

A welding rod of an alloy containing 0.01% to 10.0% zinc, 1.0% to 10.0% tin, 1.0% to 20.0% lead and the balance copper.

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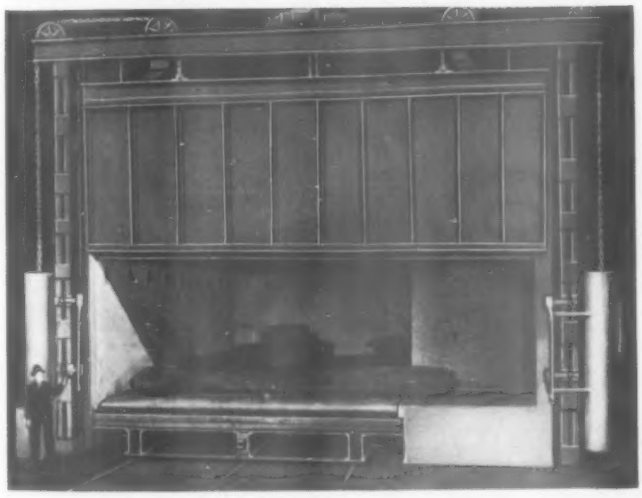

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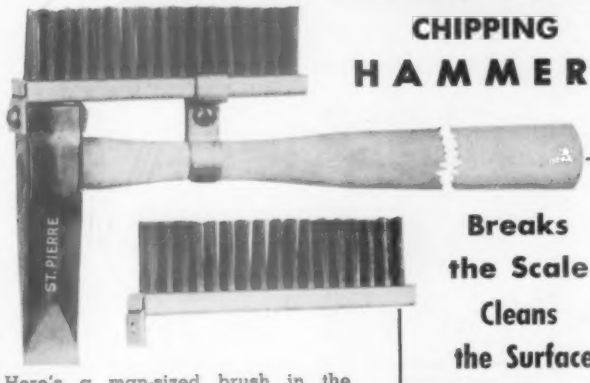

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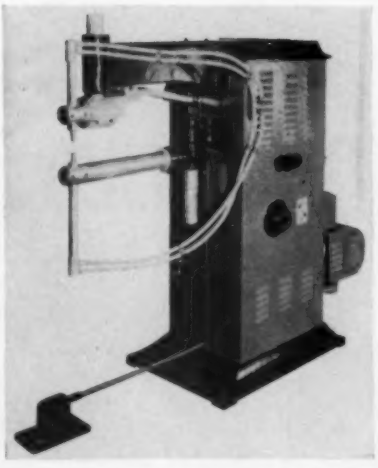

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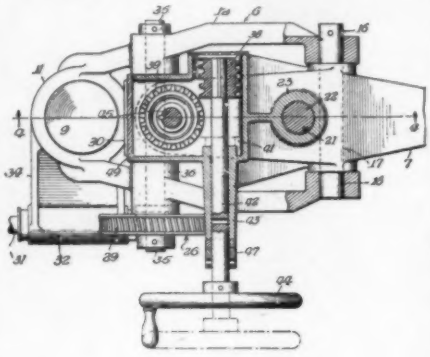
Seam and butt welders also designed and manufactured.

Write for Spot Welder Bulletin

UNIVERSAL POWER CORP.
4299 Euclid Ave. Cleveland, O.

Welding Positioner

2,318,791. **George C. Mueller,** Chicago, assigned to **Cullen-Friestedt Co.,** Chicago. Filed March 4, 1940. Issued May 11, 1943.



A work positioner adapted for use in connection with welding. A member is connected pivotally to a bracket on the base so that it is capable of being tilted in a vertical plane. To this member is connected a work-supporting table that is rotatable about its center. Irreversible gearing between the member and table rotates the latter relatively to the member; this gearing may be rendered inoperative so as to release or free the table for manual rotation.

» «

Aluminum Bronze Electrode

2,320,676. **Clinton E. Swift,** Hales Corners, Wis., assigned to **Ampco Metal, Inc.,** Milwaukee. Filed July 24, 1942. Issued June 1, 1943.

A coated electrode of aluminum bronze substantially free of iron.

» «

Electrode Coating

2,320,677. **Clinton E. Swift,** Wauwatosa, Wis., assigned to **Ampco Metal, Inc.,** Milwaukee. Filed Sept. 26, 1942. Issued June 1, 1943.

A coating for aluminum bronze electrodes (see No. 2,320,676) comprising one or more fluorides, a binder of sodium silicate and a substantially inert filler material, purpose of which is to increase the mechanical strength of the coating for handling and shipping purposes.

» «

Press Welder

2,319,095. **William A. Weightman,** Philadelphia, assigned to **Edward G. Budd Mfg. Co.,** Philadelphia. Filed Aug. 25, 1939. Issued May 11, 1943.

A multiple spot welding machine which includes a work bed, a work holder, a movable structure mounted on the work bed for movement laterally toward and away from the work, and a plurality of spot welding electrodes mounted on this structure and arranged to contact the work when the structure is moved toward it. Upon lateral movement of the structure to a position adjacent the work holder, the electrodes are engaged with the work to effect a plurality of welds.

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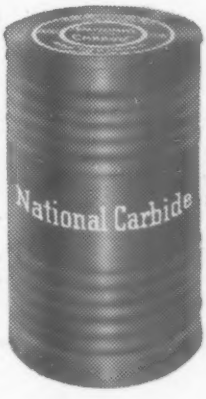

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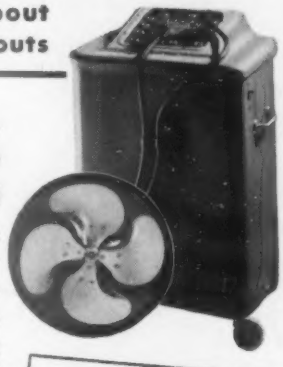

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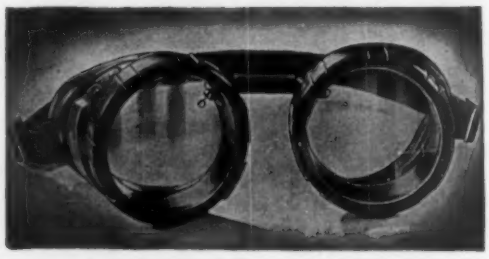

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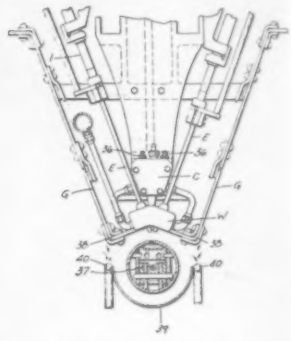
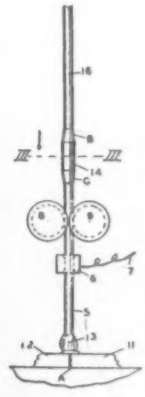
Tube Welding Apparatus

2,317,221. **Ernest Riemenschneider,** Jackson, Mich., assigned to **The Midland Steel Products Co.,** Cleveland. Filed Dec. 18, 1940. Issued April 20, 1943.



Tube welding apparatus having an elongated welding head with two electrodes and means for feeding the tubing lengthwise. Welding head extends lengthwise of the tubing and forms an enclosure above the tubing to exclude air from the welding zone. At opposite sides of the head, continuous vertical walls of moving air may be directed to confine or exclude atmosphere from the welding zone. The welding zone can be viewed through these walls of air.

» «



Electrode Connector

2,316,890. **Claire Elmer Rockne,** Napa, Calif. Filed July 4, 1942. Issued April 20, 1943.

A flux-coated sleeve for connecting two coated electrodes. Connector has tapered ends and bores in axial alignment with each other for insertion of the electrodes, the bores being the same diameter as the electrodes. The electrodes abut against a dividing wall between the bores.

» «

Welding Rod

2,317,421. **Nils K. G. Tholand,** New York City, Filed Feb. 27, 1941. Issued April 27, 1943.

A welding rod for welding stainless iron or steel. A solid integral member is made of iron and carries nickel-chromium alloy in powdered form. Alloy has hydrogen adsorbed therein. The proportion of iron, nickel and chromium in the rod is approximately the same as in the stainless steel to be welded.

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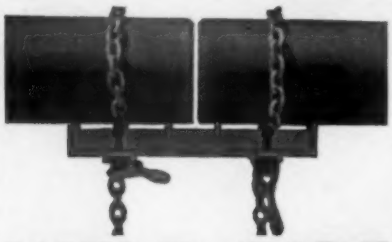

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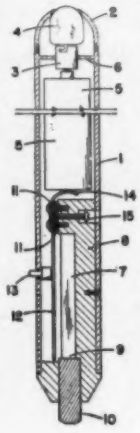
Magnetic Inspection Device

2,318,720. **Benjamin W. Sewell,** Tulsa, Okla., assigned to **Standard Oil Development Co.** Filed Nov. 12, 1940. Issued May 11, 1943.



A hand device for testing welds by means of magnetic flux. Elements are a tubular casing, a permanent magnet, an outlet for the flux extending from one end of the casing to one pole of the magnet and adapted to be placed against the weld to be tested, a signalling device mounted within the casing, an electrical circuit for operating signalling device, and a switch which opens upon the leakage of magnetic flux but is otherwise held in closed position by the magnet.

» «

Magnetic Inspection Device

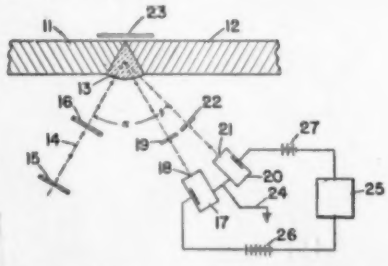
2,318,666. **William A. Bruce,** Tulsa, Okla., assigned to **Standard Oil Development Co.** Filed Nov. 12, 1940. Issued May 11, 1943.

A magnetic permeability indicator for testing welds. This is a hand device comprising a pair of concentric tubular members, a head having a metal surface to be placed against the weld to be tested, a well in the head in alignment with the inner tubular member, a soft iron core slidably mounted in the inner tubular member and extending into the well, a spring normally holding the end of the core from the end of the well, a coil for magnetizing the core arranged around the inner tubular member, a signaling means arranged in the casing, an electrical circuit for operating the signal and a switch in the circuit adapted to be operated by movement of the magnetic element into the well.

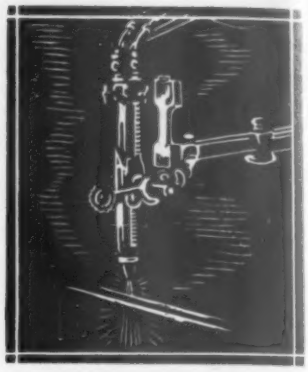
» «

X-Ray Weld Testing

2,318,667. **William A. Bruce,** Tulsa, Okla., assigned to **Standard Oil Development Co.** Filed Feb. 23, 1942. Issued May 11, 1943.



Under this method, the welded joint is exposed to a beam of X-rays while the metal is still substantially at welding temperature. While the joint cools, the shift in the first order reflection of the X-rays is observed as the metal changes from an austenitic to a pearlitic condition. The joint is quenched when the change is substantially complete.



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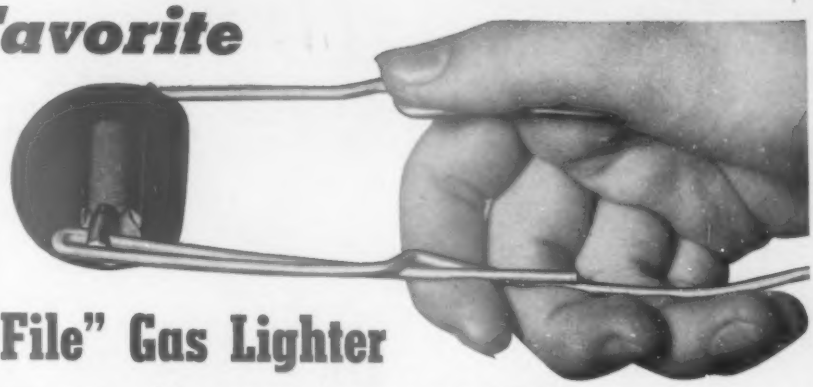

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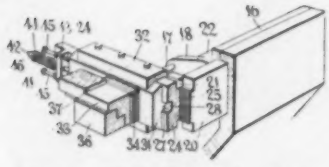

Chain Welding Machine

2,317,962. **Otto W. Winter,** Grand Island, N. Y., assigned to **Columbus McKinnon Chain Corp.,** Tonawanda, N. Y. Filed Dec. 3, 1941. Issued April 27, 1943.

In a chain link welding machine, the combination with link turning means and link upset tools of electrode mountings arranged one at each side of the ends of the link. A sliding means moves the electrode into contact with the link for resistance welding. Interposed between the electrode and slide is a connecting means having at least two relatively movable parts, one part carrying the electrode and being capable of relative movement with the other part at substantially right angles to the movement of the sliding means. The electrode clamp slide is movably carried by the machine.

» «

Marking Composition

2,318,803. **Wallace K. Schneider** and **George W. Seagren,** Pittsburgh, assigned to **Stoner-Mudge, Inc.,** Pittsburgh. Filed March 18, 1942. Issued May 11, 1943.

A marking material adapted to be applied to a metal surface preheated to a temperature of no less than 400 F. The material is capable of being subjected to thermal treatment not exceeding the melting point of the metal without loss of legibility. Its composition includes: (1) an inorganic metal oxide pigment combined by fusion with a lead borosilicate ceramic flux and (2) a cellulose ether binder.

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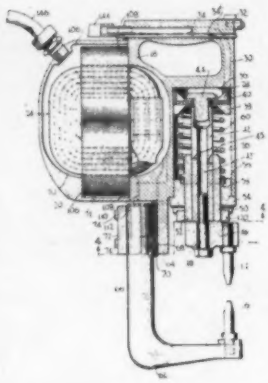

Spot Welding Gun

2,318,023. **Harold A. Strickland, Jr.,** Detroit, assigned to **Budd Wheel Co.,** Philadelphia. Filed Oct. 18, 1939. Issued May 4, 1943.

In a welding apparatus, a casing comprising a main section and a cover section together forming a space for receiving a welding transformer, a welding transformer including a core and means for securing it in position by clamping the sections of the casing against the core, a cylinder on the main section alongside the transformer having a reciprocable piston and piston rod operatively connected to a welding electrode, a second welding electrode insulatingly supported from the main section, connections from the transformer to the welding electrodes and a handle provided on the main section adjacent the end of the cylinder and to one side of the transformer.

» «

Spot Welding Gun

2,318,024. **Harold A. Strickland, Jr.,** Grosse Pointe, Mich., assigned to **Budd Wheel Co.,** Philadelphia.

In a welding apparatus, a transformer having a secondary comprising a plurality of parallelly connected hollow conductors, a terminal connection for these conductors comprising a hollow tubular portion merging into an open end channel, apertures in the channel for receiving the ends of the conductors from the opposite side from the flanges of the channel portion, and a cover plate to form a closed distributing chamber of the channel portion.

The hollow conductor windings of the transformer secondary form at least two layers, one arranged in concentrically spaced relation around the other. The space between the two layers of secondary conductor windings is filled by primary windings. Through the hollow secondary windings, a coolant may be passed to cool both secondary and primary windings.

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